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GAS JOURNAL

LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLV. No. 3040.] LONDON, AUGUST 17, 1921. [73RD YEAR. PRICE 1s.

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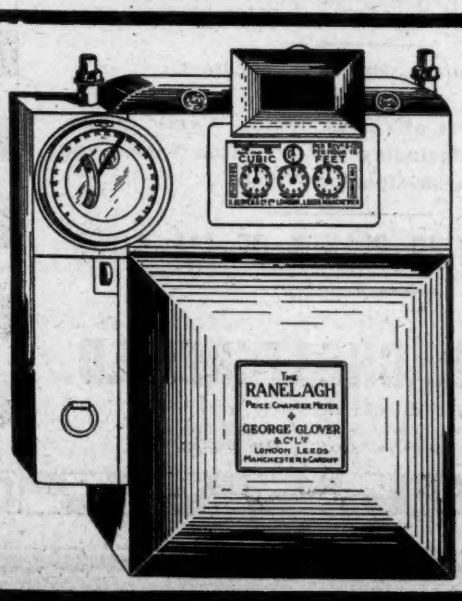

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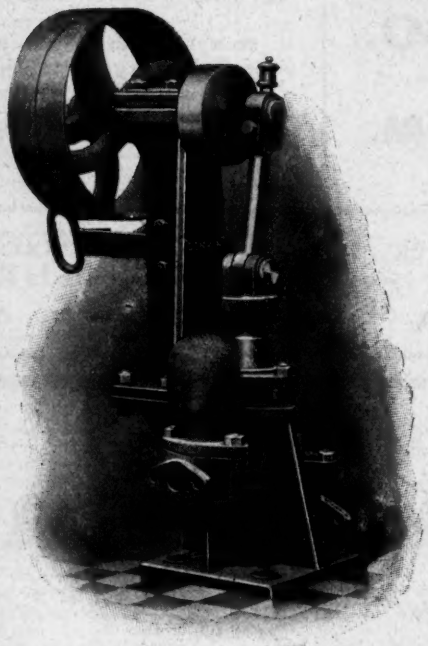

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLV., No. 3040.] WEDNESDAY, AUGUST 17, 1921. [73RD YEAR.

EDITORIAL NOTES.

Unwanted Coal.

UNLESS market reports are very deceptive (and there are the best of reasons for knowing that they are not), supplies of coal have already outstripped present demand. Exceptionally heavy stocks are reported to be lying at collieries in the Midlands, in Wales, and in Scotland; and from the North of England the reports speak of a "slump," in both the home and export requirements. From Wales the news comes that the colliery sidings are choked with filled trucks, and that there will not be wagons available presently for the daily growing output. One explanation of this is that France and Italy are not buying in anything like their normal quantities. The result is that at some pits the miners are once more idle. Although the number of men employed is not so great as before the strike, the output of coal has been creeping-up week by week since the resumption of work, until in the last week in July the production was 4,587,300 tons. Then, again, the information is published that in South Wales pit-head prices have shed several shillings per ton, and that the Cardiff District Coal Factors and Merchants' Association have decided to reduce the price of household coal by 8s. per ton. Although the latter is not likely to make any difference to the London household coal market, it is a sign of the times. Also from Durham and Northumberland the intelligence arrives that there is keen competition for business, and the values have fallen, as is the case in Scotland. Some of the Lancashire and Cheshire collieries have been holding-out for the 3s. per ton advance, but not all of them. The truth is that the coal trade is in a state of chaos. One writer picturesquely attributes this to "buyers being on strike." There is some amount of truth in this; but it is not the whole truth. It may aptly describe the position so far as householders are concerned; but in respect of industry, business has been killed to such an extent through a combination of circumstances (among which coal is a prominent one) that industry does not want coal, and sees little use in working to maximum capacity while coal and labour are at their present cost levels, and foreign competition so easy. The whole position is eloquent of the fact that coal prices cannot be ruled by artificial means or arbitrary decisions, and that economic laws cannot be disregarded. The point receives illuminating illustration in the announcement of a temporary closing-down of the works of Messrs. Yarrow & Co., Ltd., who state that through strikes, reduction of output, and demarcation disputes in various industries, the cost of shipbuilding has now become excessive, and it is impossible to promise dates of delivery. They believe, however, that prosperity will return "when "everyone realizes that commercial undertakings can only "be carried on with success in accordance with economic "laws." As soon as these laws are recognized, the firm will reopen their works. There is a moral in this not only for the workers in the shipbuilding industry, but for the coal owners and miners, and industrial workers generally. The inter-relation of industries has been a much ignored fact.

Supply of and Demand for Nitrogenous Fertilizers.

IF by looking at facts squarely in the face, the deductions drawn are not the most pleasant, this does not necessarily imply a pessimistic temperament. It may mean prudence. From the point of view of prudence, it is always better, if prospects appear bright, rather to under-estimate them; and if the conditions forward look dull, it is better somewhat to over-estimate their effects. In this attitude and practice, there is a margin of safety; and if eventually the result is better than is estimated, the satisfaction will be all the greater. These remarks are made because there is no wish that it should be thought we are taking an unduly pessimistic view of the future of the sulphate of ammonia market; but it would be adopting a very venerable piece of folly to close one's eyes to developments assailing the stability of old-time conditions. There has been too much of that kind of thing in this country; and many men have only been made aware of the fact by a shock that has had drastic effects. We do not for a moment believe that the bye-product sulphate of ammonia market is going to fall to pieces. Economic conditions affecting production and marketing will fall into line in effecting a balance which will still leave a profit to the bye-product commodity, but perhaps not the old rate of profit.

In the statistical supplement to the final report of the Nitrogen Products Committee of the Ministry of Munitions (which was noticed last week), Dr. J. A. Harker appears inclined to take an optimistic view of the commercial future of nitrogenous fertilizers, although he admits that definite conclusions are impossible as to the *post*-war demand for fixed nitrogen—more especially that required for fertilizer purposes. He goes on to say that "for certain countries, "where a forecast is possible, examination of the prospects "indicates that, although the potential output has been "greatly increased by the provision of large fixation plants "during the war period, yet the total demand for fixed "nitrogen is still growing at an even greater rate." If this is so, how is it that—the law of supply and demand having come into operation—values have had such a sharp decline within the past few months? It shows how sensitive the markets for nitrogenous commodities are, and how values were formerly being upheld by more or less artificial means, and not by the normal movements that affect markets. It is perfectly true the home demand has increased largely; it is equally true that the demand has increased in other countries. It is hoped that the increase there has been in this country will not only continue, but further develop. There is no reason why it should not. All the better if it does. But in drawing conclusions, there is little reliability in utilizing for the formation of judgment a comparison of the consumption statistics of 1912 and 1919, in view of the intensive culture of scientific manuring that has been going on during war time for the express purpose of increasing food production, through the efforts of the Ministry of Agriculture and the predecessors of the Sulphate of Ammonia Federation, Ltd.

It has to be remembered that increase in the growth of production capacity is an easier matter than increase of demand. There are no limitations now to the production of sulphate of ammonia or its cognates or equivalents, such as were set at one time by carbonization and the relative market values of sulphate of ammonia and nitrate of soda. The only limit that production capacity need have to-day is that of the produce being profitable under the particular system of manufacture. The figures given by Dr. Harker do not satisfy us that, whatever the conditions in "certain "countries," the world's demand for nitrogenous fertilizers is to-day growing, or will grow in the future, at a greater rate than the aggregate producing capacity of the several systems. He gives figures which show that the world's productive capacity in nitrate, bye-product sulphate of ammonia, cyanamide, nitrate of lime, and synthetic ammonia has been more than doubled since 1912. The world's total resources in nitrogen products in 1912 were 4,018,286 long tons; in 1920, 8,551,900 long tons. The output of nitrogen

in 1912 was 715,678 metric tons; and in 1920, 1,555,300 metric tons. What caused the productive capacity to double in that time? War conditions. But this shows that productive capacity is a more facile thing to extend than demand. The greatest developments have been in cyanamide and synthetic ammonia. In 1912, the cyanamide productive capacity was only 126,538 long tons; in 1920, 1,777,000 long tons. Against synthetic ammonia plants in 1912, "*nil*" is placed; for 1920, there appears as the productive capacity 1,503,000 long tons. These are significant figures. They show where flexibility of production resides; and that flexibility is not the property of any one country. Utilization of it is being made here. Another notable point is that the fixation industry is now the largest contributor to the nitrogen requirements of the world. It is also worthy of note that, despite the extensions of synthetic ammonia plants, new cyanamide plant has been installed during the war period to such a capacity that the potential output by this process is still larger than that of any fixation process. Some people have been under the impression that the fixation of nitrogen through the intermediary of cyanamide was becoming a thing of the past, owing to the competition of the synthetic ammonia process. Admittedly, cyanamide has inherent disadvantages, and there are difficulties in the application of large quantities of the substance. In spite of disadvantages and difficulties, there is the fact of a largely increasing production during the war period—in several countries works having been erected.

However, in the case of all these competitors, there is a point beyond which they cannot profitably produce; and they are not likely to cut their own throats. Where that point is, we cannot say. The position is yet too ill-defined. But one thing that is positive is that the trading environment of bye-product sulphate of ammonia has entirely changed. This will have to be recognized to the full, however distasteful it may be. Everything must and will be done to maintain for bye-product sulphate a position as a contributor of profit to the carbonizing industries. All this article is intended to do is to emphasize some very plain facts in the current position.

Dealing with the Corrosive Constituents of Gas.

THE report of the Life of Gas-Meters Joint Committee of the Institution of Gas Engineers and the Society of British Gas Industries has been liberated for publication. In it we again see the careful work and compilation industry of the Research Chemist (Mr. J. G. Taplay). Step by step the investigation of experiences and the chemical and physical researches are bringing the various corrosive agents in coal and water gas under control, or rather pointing-out how they may be dealt with so as to render them inactive or harmless. The remedial means—except (for the present) hydrocyanic acid—are simple and easily applicable; but we are afraid there are many gas engineers who prefer to go on the old way, owing to the cost of application and the little additional trouble that is occasioned, overlooking the destructive influences on capital and maintenance costs which neglect of preventive expedients entails.

It will be seen that the present report particularly shows how sulphur dioxide may be dealt with. The effects of blue water gas, unless due precautionary neutralizing methods are applied, are now substantially known. The remark is made that such gas may easily be the cause of trouble if it be allowed to go forward with an acid reaction. We also get a definite figure regarding the quantity of oil required for carburetted water gas. It "is only neutral when the blue "gas is carburetted to the extent of 1½ to 2 gallons of oil per "1000 c.ft. Even then, it depends upon the amount of sul- "phur both in the coke and the oil." The quantity is high in view of the price of 5½d. per gallon of oil net and naked, *ex* wharf. It hardly squares with the "slight" carburation that has been spoken of by some engineers, and which has been translated into a gallon or a fraction under per 1000 c.ft. It looks like a minimum of 1½ to 2 gallons; but there would be interest in knowing whether the oil quantity per 1000 c.ft. of water gas would be subject to the percentage of carburetted water gas in the bulk of gas distributed, and the composition of the coal gas. The report also contains some warnings. For example, there should be a very careful analysis of artificial oxide before it is used, as certain samples have been found to contain elements exercising a pernicious influence. However, it is satisfactory to know that the various corrosive agents are well within the possibility of removal or control from aggression in a more or less complete degree, save—temporarily, it is hoped—in the case of hydrocyanic acid. Regarding this, last year's report told us that for its elimination there was still lacking a simple process suitable for adoption by the smaller gas undertakings, and in this direction experiments were being continued. The hope met with a rebuff up to a point. Numerous attempts were made to obtain what is required; but, while more or less successful, they did not result in a process sufficiently simple. Now, however, it looks as though something promising is within sight; for the report states that a method has been tried which has given excellent results in the laboratory. It is believed that fuller information will soon be available; and to this the gas profession will look with considerable interest.

Another section of the report follows up the question of the spraying of meters, as well as the effect on meters of introducing atomized or vaporized oil into the mains; and an inquiry as to results has been instituted among those gas undertakings that have been engaged in either one or the other or both practices. The collection of experiences is interesting, though varying; but we are inclined to think the differences are not due so much to the processes adopted for ameliorating trouble as to the conditions with which any one or other process is expected to deal. One lesson upon which emphasis is laid is that much depends upon the selection of the oil for meter-spraying. An oil is not wanted that will wash the dressing out of the leathers, nor the grease from the stuffing-boxes, nor is a heavy oil desirable that will leave behind a sticky residue to produce other defects in working. The oil specification recommended is: A mineral oil of high boiling-point, with a specific gravity not less than 0·85 (preferably higher), and which will not ultimately leave behind a gummy residue. Partly due to the unsuitability of the oil are the variations of experiences; but a good deal of indifferent experience may be attributable to the leather diaphragms having been ruined, and so past redemption, before the application of spraying commenced. This spraying of meters by oil, however, should be regarded as more or less a temporary expedient, as the indication of a considerable experience is that where oil has been atomized into the gas, or has been introduced into the mains in the form of vapour, for years the need for meter-spraying does not exist, and even the diaphragms are found in good condition. The works is the proper place to deal with this matter, as mains and services, as well as meters, are objects of attention by the corrosive constituents of gas unless they are protected. But some engineers expect quick effects after starting the introduction, by atomizing or vaporizing, of oil into the mains. Good effects take time to present themselves so far away as the meters in parts of a district; and until they are realized at the meter end, meter-spraying, correctly practised, is a proved advantage, if deterioration has not vitally affected the leathers and other components. But some engineers try to make a gallon of oil go too far; others not far enough. One practice is as bad as the other in preventing the realization of maximum efficiency, where the meters are in appropriate condition for treatment.

Further interest will be found in the parts of the report dealing with the effects of wrong location in promoting corrosion of meter casings. Also from the extracts given from reports by a Special Committee of the American Institute, it will be seen that treated upon is the limit of period within which gas-meters should be brought in for overhauling and testing. The appropriate period has relation to meter situation and the deteriorating influences to which a meter is subjected, Anyway, the American Committee suggest that a ten-years' run is quite long enough for a meter before being submitted to examination, repair, and re-testing. Our own meter makers, we believe, think the same; but the opinions on the subject of some gas undertakings, as expressed by practice, are found to be capable of standing great tensile strain. After the treatment to which meters have been subjected during the war, views and periods may well be shortened.

Statutorily Regulated Factory Lighting.

TRAVELLING up and down the country, and visiting factories of all descriptions, one is much struck by the great variation that exists in the artificial lighting of such places. The variations extend from the crude and almost primitive to some really scientifically arranged examples of lighting. There is every reason why the best that can be given in

artificial lighting should exist in industrial establishments. Not even the excuse of economy can be legitimately made to justify the discreditable "illumination" that is found in many of them. Good lighting has every argument on its side—safety of workers, preservation of their eyesight, their comfort and convenience; and there is no question that—dissociated from the application of the false dogma of ca'canny—bad, defective lighting is an enemy to high production, and is opposed to economical works' costs. But, of course, the mere change from a system of lighting suffering from senility to one of the modern systems—gas or electric—does not necessarily mean good lighting. Modern systems require treatment to produce with them the maximum efficiency, which means good uniform light, unvarying, unflickering, dependable, and destitute of harmful glare and annoying shadow. To realize all this means the study by the lighting expert of the conditions in the particular circumstances of each works, and not the haphazard treatment which has become far too much the vogue, and certifies the gigantic ignorance of those responsible. Very unsatisfactory illumination can be, and is, obtained by modern systems of lighting. The illumination given may be quite sufficient in volume; but it may be lamentably deficient in physical qualities.

The time arrived long since when the proper artificial lighting of industrial establishments should have been made as compulsory as certain other things which appertain to factory regulation. Nothing but compulsion will be effective in many cases. Before the war, the Home Office appointed a Departmental Committee on the Lighting of Factories and Workshops. After presenting their first report, the inquiry was suspended. The Committee have resumed their work; and they have now, in a second report, made some recommendations that are fundamental to the subject in hand, and later on will go with greater exactitude into the matter of details. In parts we agree thoroughly with the recommendations of the Committee. In one important respect we do not, and should strongly advise the National Gas Council to protest against and resist the adoption of at any rate one of the proposals. We do not for a moment question the impartiality and *bona fides* of the members of the Committee; but seeing the large interest that the gas industry has in this particular matter, we do claim that a gas-lighting expert should have been a member.

The Committee have adopted the definite policy of making statutory the obligation to provide adequate and suitable lighting in every part of a factory or workshop, and of giving power to the Secretary of State to make Orders defining adequate and suitable lighting for a factory or a workshop, and for any process carried on in the one or the other. The Committee have in view adequacy and suitability from the points of view of safety and health, a reasonable degree of constancy and uniformity of illumination for the necessary area of the work, the placing and shading of lamps so that the light does not fall on the eyes of the operator, and the placing of lights so as to avoid the casting of extraneous shadows. "Glare" is rightly an abomination in the eyes of the Committee; and "glare" is what above all things has to be avoided in the judicious exercise of the art of illumination.

So far we are in complete accord with the Committee. It is when we come to their specific recommendations on this subject of glare that there is a break in the accord we have with them. Injurious glare is the result of the conditions existing at the source; and a big source of light may not necessarily be the source of injurious glare. It depends largely upon the ratio of the light emitted to the area of the source—the smaller the area for any given amount of light, the greater the intensity. And injurious glare (composition of light is not taken into account) seems to be regarded by the Committee as a common property of the sources of light. The Committee suggest that "proper shading" could be defined by prescribing maximum brightness over the shades not exceeding a given number of candles per square inch; or (they add) a practical alternative is given by taking as a simple criterion whether or not an incandescent filament or mantle or flame is distinguishable as such through a shade. We strongly object to both these suggestions. We resent any source of light of the area of an incandescent mantle being subjected to the same decisions as a source of light (with a parity in light-giving) having the small area of an incandescent electric filament. The two things are not comparable in respect of physical effects. With regard to the first suggestion—the prescribing of maximum brightness for shades not exceeding a given number of candles per square inch—the Committee remark that this would involve complicated measurement. We do not see why it should. It would be easy enough for manufacturers for different light sources of defined maximum intensity to produce shades that, with each particular light source, would, at its own maximum efficiency, give a brightness not exceeding a given number of candles per square inch. There should be no difficulty about this.

However, the first recommendation of the Committee proposes that every source of light (except one of low brightness), within a distance of 100 ft. from any person employed, shall be so shaded from such person that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20°, or in the case of any person employed at a distance of 6 ft. or less from the source, not less than 30°. However appropriate this recommendation may be for a source of light having the restricted area of an electric filament, we strongly object to such a large area as an incandescent mantle (for equal lighting powers) being made indistinguishable to a normal or any other eye through a shade under these or any other defined conditions. In the interests of lighting economy, the objection is pressed; and more particularly when we see that "low brightness" is defined as meaning an "intrinsic brilliance of not more "than 5 candles per square inch." Referring to the "light "source," this would rule-out all modern electric lamps; and it would equally exclude relatively large-area mantles of low as well as high pressure gas lighting.

There is not the same objection to the other recommendations, which are designed to prevent direct reflection of the light from a smooth or polished surface into the eyes of the worker, to prevent the formation of shadows which interfere with the safety or efficiency of any employee, and to prohibit the use in a factory or workshop of light sources which flicker or undergo abrupt changes in candle power in such a manner as to interfere with the safety or efficiency of any person employed. This last-named condition would, if adopted, mean the exodus of electric arc lighting, particularly the flame variety. There is agreement, too, with the recommendation that, as regards existing installations, a reasonable time-limit should be given before the various requirements become operative.

Local Enamelling of Gas-Fire Casings.

SUFFICIENT consideration is not always given by gas administrators to some matters that are essential to the full prosperity of their central business. These things have been crystallized into the expression "good service"—a term fruitful in both meaning and action. All applicable aids to the maintenance and progress of gas custom should be used—if reasonably possible. Of course, the price of gas stands foremost; the periodical inspection and regulation of gas-using appliances comes next; and facilities for economically replacing parts, repairing and renovating privately owned appliances, should also be provided. The business that clusters round the main or central part of gas trading appears to be almost infinite. The Croydon Gas Company have inaugurated a new branch of work in meeting the needs of their customers; and as it is so promising, and is growing continually in popularity, it is a matter of which the gas industry generally should know. During a visit to the workshops of the Company's Distribution and Sales Department, information as to the new development was obtained from Mr. W. J. Sandeman, the Distributing Engineer and Sales Manager. To put it briefly, the Company have gone into the gas-fire enamelling business. At first blush, this may not appear to be a notable innovation for a gas company. But there is more in it than meets the unobservant eye. There is no question in our minds, after what has been learned, that it is going to have an excellent effect on the heating business, by helping compliance with the spreading desire of gas consumers to get away for certain of their rooms from the black-finished stove, and to have fire-casings in colours that harmonize with their tiled surroundings, or the predominant colouring in a room.

We will not go in detail into the matter here; the information will be found in the descriptive article that appears on later pages. But the experience brings out these salient facts: The Company are able (and the work is done in a superior way) to take from stock fires black finished in the

makers' style, enamel them in any wished-for colour, and supply them to customers at a cheaper rate than the price at which they can buy art enamelled stoves from the manufacturers. This is one distinct advantage to the gas business. Another is that colours and shades are not limited. A further one is that installed fires can—locally, quickly, and at a moderate charge—have their casings converted from one colour to another, or to old gold, bronze, or armour bright, just as they desire. It is the business of gas undertakings to meet the needs of their customers, and as economically as possible. The Croydon Gas Company are doing so in this respect. The gas-fire manufacturers cannot logically object. They want greater production to reduce costs; and greater production can only be obtained by increasing public demand. Anything that popularizes will lead to an extension of the demand; and the work that the Croydon Company are developing in relation to the enamelling of gas-fire casings will render effective aid. At first, Mr. Sandeman confesses, the work seemed a difficult thing to tackle; but success rewarded endeavour. Any gas undertaking who desires to follow this example of a paying development—paying in more senses than one—cannot do better than get an intimate grip of the particulars in the article on the subject published in this issue, and then, if possible, see the process as actually worked. The experience of the Company in this direction we know is freely at the service of the industry generally.

Gas Coal Supplies.

From all the coalfields, the market reports announce that supplies of gas coal are now plentiful, and that demands are being readily met. The idea is prevalent in them all that gas undertakings are busy accumulating reserves in place of those that were exhausted during the strike.

Railway Control.

Last Sunday at midnight, railway control came to an end. The railways have been under Government control since the declaration of the War. The Railway Bill was read a third time in the Commons last week; but not before Sir Fortescue Flannery, Bart., one of the Directors of the South Suburban Gas Company, had expressed his regret that the Bill contained no provision for co-partnership or co-working. He was able to bear testimony to the value of directors elected by the employees of the Company referred to, having worked side by side with them for so many years.

Safeguarding of Industries Bill.

It is hoped to prorogue Parliament on Friday. There is just one chance of a slip. The Safeguarding of Industries Bill was read a third time in the House of Commons on Friday; and later on in the day a first time in the Lords. The Speaker has ruled that the measure is a Money Bill for the purpose of the Parliament Act; and so the Lords are unable to amend or reject the measure. If the opposing Peers adhere to the technical right to have the Bill sent to the Upper House a month before the end of the session, it will be necessary for Parliament only to adjourn on Friday, and hold a formal meeting for the prorogation at the expiration of a month from the Bill being sent to the Lords. But nothing of the kind is expected.

The Price of Steel.

In order to meet foreign competition, the South Wales Siemens Steel Association have reduced the price of steel bars by £1 a ton to £8 10s. It is stated that Belgian bars are being delivered here at £7 5s. per ton. Blast-furnaces are only slowly being set to work again—coal prices being largely responsible for their continued inaction. The "Iron and Coal Trades Review" estimates that there are only twenty blast-furnaces in operation now, as compared with 300 in blast a year ago. It is noted that, at a meeting of the ironmasters and members of the Blast-Furnace Coke Sales Association, it has been decided that the minimum price of blast-furnace coke for inland use shall be 30s. per ton at the ovens for any period up to Dec. 31 next.

Gas and Fuel Oil.

The increasing demands for gas and fuel oil are reflected by the import returns for July. Lower prices have had a stimulating effect. During the month the receipts of gas oil amounted to 12,666,828 gallons, compared with 4,415,913 gallons in July, 1920. Fuel oil reached the figure of 64,079,318 gallons last month, contrasted with 27,321,460 gallons in July last year. The value of the gas oil imported during the seven months of this year is put at £1,589,087.

Coal and Coke Exports and Values.

The shipments of coal abroad last month showed a partial revival. Some 816,320 tons were dispatched, compared with 2,096,996 tons in July, 1920, and 6,975,211 tons in 1913. In these figures are respectively included 177,320 tons, 202,151 tons, and 414,572 tons of gas coal. The value of the 177,320 tons of gas coal last month is given as £350,212, compared with £823,993 for the 202,151 tons in July, 1920. There were only 1684 tons of gas coke exported last month; the value attached being £1979, or about £1 3s. 6d. per ton. In July last year 80,091 tons were exported; the value then being £501,123, or £6 5s. 1·66d.—an average value higher by £5 1s. 7·66d. than that for last month.

PERSONAL.

The National Board for the coal industry, composed of representatives of the coalowners and the Miners' Federation, agreed that Sir WILLIAM PLENDER should be the independent Chairman under the terms of the recent settlement. The Lord Chief Justice had been asked to make the appointment, and both sides agreed to his choice. Sir William Plender, who is the senior partner in the firm of Messrs. Deloitte, Plender, Griffiths, & Co., was President of the Institute of Chartered Accountants for two years, and acted as Hon. Financial Adviser to the Board of Trade in 1918. He has served on many Departmental Committees, and possesses special knowledge of colliery finance. As much of the work of the Coal Board will be concerned with accountancy, it is felt by both sides that the appointment is a satisfactory one.

Sir ERNEST V. HILEY, formerly Town Clerk of Birmingham, and more recently Chairman of the Metropolitan Railway Carriage and Wagon Company, has been adopted as prospective Unionist candidate for the Parliamentary Division of Duddeston, Birmingham. The bulk of the city's gas-works are situated in this division.

Mr. ROBERT S. GARDINER, by a decree dated May 7 last, has been promoted to the grade of Officier of the Légion d'Honneur. His colleagues both in France and England offer him their warmest congratulations. In making this announcement, the "Journal des Usines à Gaz" remarks that Mr. Gardiner, a member of the Société Technique, is a fine example of Anglo-French "solidarity." The eminent services he has rendered to the industry in France—especially as regards its coal supply—have now met their due in his promotion in the Légion d'Honneur.

OBITUARY.

The death is announced, at the age of 59 years, of Mr. WILLIAM LINDLEY, the Manager of the Dukinfield Corporation Gas-Works. This position he had held since 1905, when he succeeded the late Mr. Harrison Veevers.

Some particulars of the career of the late Mr. T. H. NIXON (whose death at Walton-on-Thames, at the age of 70 years, was recorded in the "JOURNAL" a fortnight ago), are given in the "Co-Partnership Journal of the South Metropolitan Gas Company." From these, it appears that Mr. Nixon was Chief Draughtsman of the Phœnix Gas Company, whose service he entered in the middle of the 'seventies, when the late Sir Corbet Woodall was Engineer of the Vauxhall and Bankside gas-works. While occupying this post, Mr. Nixon made the designs for much of the new work then undertaken—notably purifier, exhauster, and retort-house extensions at Vauxhall, and the remodelling of the gas-holder station at Kennington, including the important work of the construction of No. 1 holder and tank, which for some time held the record as being the largest in the kingdom. Upon the amalgamation, 1880, Mr. Nixon became Chief Draughtsman of the united undertaking, and was especially responsible for preparing the designs of the East Greenwich works, under the late Sir George Livesey and his brother Frank. Mr. Nixon was also the draughtsman for a good deal of the extensions of the Old Kent Road and Rotherhithe stations which were carried out about this time.

Annual Meeting of the Institution of Gas Engineers.

We are informed by the Secretary (Mr. Walter T. Dunn) that the annual general meeting of the Institution of Gas Engineers, postponed from May 24, has now been definitely fixed to be held in London on Tuesday, Oct. 11 next, and the two following days, under the presidency of Mr. Thomas Goulden, M.Inst.C.E., Chief Engineer to the Gas Light and Coke Company. Particulars as to place of meeting and other details will be issued in due course. The visit of the Société Technique de l'Industrie du Gaz en France, which it was hoped would have taken place in connection with the meeting, unfortunately has to be postponed until next year, owing to the members of the Société being unable to attend at the autumn period of the year.

RADIATION LTD. AND PUBLICITY.

A Campaign in the London and Provincial Press.

MANY men in the gas industry have received a letter from Radiation Ltd. announcing a fresh piece of enterprise. A copy has been sent to us for publication; and we give it in its entirety, in order that the whole industry may have preliminary knowledge of the new movement. The communication reads:

Aug. 15, 1921.

Dear Sir,—We have already announced particulars of a series of gas-grates sufficiently varied in design to give the consumer a wide range of choice, but with all the working parts standardized and interchangeable. Other apparatus has also been standardized, and soon the "Radiation" standard cooker will be available.

These will be followed by further important developments, which will be announced in due course.

The combination of resources and experience which has made possible these great forward steps has now enabled Radiation Ltd. to organize a National Advertising Campaign. Advertising will commence on Sept. 15 in all the foremost London morning and evening newspapers, including—

"The Times"	"Evening Standard"
"Daily Mail"	"Evening News"
"Daily Telegraph"	"Daily Express"
"Daily Chronicle"	&c.

And in the Provincial Press as follows:

"Birmingham Post"	"Newcastle Chronicle"
"Manchester Guardian"	"Yorkshire Post"
"Liverpool Post"	"Western Morning News"
"Western Daily Press"	"Sheffield Daily Telegraph"
"Cardiff Western Mail"	"Glasgow Herald"
"Scotsman" [Edinburgh]	&c.
&c.	

There will also be advertisements in weekly journals—such as "Punch," "Country Life," &c.—and in the Architectural, Builders', and Technical Press.

This extensive advertising will give added emphasis, and be complementary, to the great work which the British Commercial Gas Association is doing in bringing the advantages of gas before the public, and will bring many inquiries from your consumers by personal visits to your show-rooms and by post. In addition to the inquiries you receive yourselves, the Radiation firms will undoubtedly receive many inquiries direct; and, with your approval, we propose that these shall be forwarded to you.

Meantime, any further information will be gladly supplied by:

ARDEN HILL & CO.,
Acme Works, Aston, Birmingham.

The DAVIS GAS-STOVE COMPANY,
60, Oxford St., London, W.1, and Luton.

FLETCHER, RUSSELL, & CO.,
Palatine Works, Warrington, and London.

The RICHMOND GAS-STOVE & METER COMPANY,
164-172, Queen Victoria St., London, E.C.4, and Warrington.

WILSON & MATHIESONS,
Carlton Works, Armley, Leeds, and London.

JOHN WRIGHT & CO.,
Essex Works, Aston, Birmingham, and London.

Yours faithfully, RADIATION, LTD.
T. B. PEATTIE, Secretary.

SPONTANEOUS COMBUSTION IN MINES.

THERE was appointed nine years ago a Committee to inquire into the circumstances in which spontaneous combustion of coal occurs in mines, its causes, and the means of preventing it, or of dealing with it when it has arisen. The Chairman is Sir R. A. S. Redmayne, K.C.B., who was at that time Chief Inspector of Mines. At the close of 1913, the Committee made an interim report on that part of the inquiry relative to the danger to persons employed in a mine during the occurrence of an underground fire occasioned by the spontaneous combustion of coal or other carbonaceous material. They then stated that they proposed continuing their investigations in other directions, to discover the means which should be adopted towards preventing the initiation of spontaneous fires, and the means which should be taken to combat them when they occur. What they have done forms the subject of their final report, which was published at the end of last week by H.M. Stationery Office [price 1s. 6d. net]. Among the large number of witnesses who were heard at the twenty-six meetings devoted to the taking of evidence were Prof. P. F. Bedson, Prof. W. A. Bone, Dr. J. S. Haldane, Mr. F. S. Sinnatt, and Dr. R. V. Wheeler.

After a brief historical review of the subject, the Committee consider the probable cause or causes from the scientific point of view of the initiation of spontaneous combustion of coal in mines. The possibility of the self-heating of coal being initiated by bacterial action was suggested by Dr. Haldane in evidence in 1914, when he said he felt that the subject was of such importance as to warrant further investigation. Nearly a year later, Mr. T. F. Winmill (Dr. Haldane's Chief Assistant at the Doncaster Coal-Owners' Laboratory) described experiments that had been conducted by him on the self-heating of coal, and, in explaining curves showing the rate of oxidation, stated that these were somewhat remarkable in form, as they showed comparatively an enormous rate of oxidation initially, which, however, fell off rapidly as time went on. This was just the reverse of what would be expected if the action were bacterial. Further, Mr. J. T. Graham (one of Mr. Winmill's assistants) determined the rate of oxidation of coal after it had been subjected to a temperature of 100° C. *in vacuo* for twenty hours (a temperature which would completely exterminate all bacteria); and he found that the rate of oxidation was quite unaffected by the sterilization. These facts appeared to the Committee to constitute conclusive evidence against the bacterial action theory as applied to the self-heating of coal.

Though Dr. Wheeler informed the Committee that he had made some experiments which seemed to show that moist coal did not absorb oxygen as readily as dry coal, he stated that he would not like to say definitely that moisture had no effect. Prof. Bone described experiments of Parr and Kressman, in America, who found that in coal with conditions otherwise favourable to oxidation, the oxidation would be facilitated by moisture. Mr. Winmill in his evidence said experiments made by Mr. Graham showed conclusively that moist coal oxidized more readily than dry; and this was in accordance with general chemical theory. He found that moist coal absorbed oxygen 50 p.ct. faster than dry coal—the word moist being used in the chemical, as opposed to the physical, sense.

Considerable space is devoted to discussing the effect of the presence of pyrites; and with a view to clearing-up some doubts which the Committee had as to the part played by pyrites in the self-heating of coal, they asked Dr. Wheeler to carry out certain experiments. This he did, and said the results showed clearly that, under the conditions of experiment, the presence of pyrites did not increase the rapidity of oxidation, but exerted a hindering action—probably behaving in the same manner as other inert material. The evidence given with regard to the effect of the absorption of oxygen by the coal substance is then weighed; and the Committee proceed to put forward the main conclusions arrived at by them as to the scientific explanation of the self-heating of coal.

They give it as their opinion that:

1.—The self-heating of coal is not in any way due to the presence of bacteria.

2.—Some small amount of heat may in certain circumstances be developed by the oxidation of pyrites in coal; but the effect of this heat is negligible. The chief part played by pyrites when present in an unstable form is that of a disintegrator of the coal, so rendering the latter more permeable by air, and exposing a greater area of coal substance to oxidation.

3.—The presence of moisture in coal has an accelerating effect on its oxidation; and consequently coals high in hygroscopic moisture absorb oxygen more readily than those of low moisture content.

4.—The self-heating of coal is mainly due to the absorption of oxygen by the coal resulting in the generation of heat.

5.—Though coal absorbs both oxygen and nitrogen in a physical sense as well as in a chemical sense, the absorption in so far as heating effects are concerned is a chemical, and not a physical, process. The chemical process is mainly one of the attachment of oxygen to molecules of high carbon content. But subsidiary to this, and playing an important part in determining the actual spontaneous ignition of coal, is a chemical interaction between the oxygen thus loosely held by the carbon-like molecules and other atoms in these molecules or other portions of the coal conglomerate.

6.—From the chemical standpoint alone, the higher the percentage of oxygen contained in a coal, the greater, it would seem, is the liability of spontaneous combustion.

7.—The temperature of the coal is a matter of great importance, seeing that the more permeable is a coal, other things being equal, the greater are the effects of oxidation, inasmuch as a greater surface is exposed to the action of the air as compared with coal of a closer texture.

8.—As the temperature rises, the rate of absorption of oxygen increases.

The next section of the report deals with the subject from the practical point of view—*i.e.*, the conditions in the mine which are conducive to the occurrence of self-heating of the coal, and the means which should be taken to prevent fires, or to cope with them when they occur. This portion of the report is accompanied by many sketches. Next there is explained the method, largely practised on the Continent, of packing the waste by what is known as hydraulic stowage; but no definite views are laid down with regard to its adoption as a means of preventing spontaneous combustion underground. With reference to the section already mentioned dealing entirely with the practical aspect of the subject, the Committee have reached various conclusions, which are enumerated. They do not recommend the establishment of regulations additional to those brought into force as the result of their interim report, which they regard as sufficient in present circumstances.

The autumn meeting of the Iron and Steel Institute will be held at the headquarters of the Comité des Forges de France, 7, Rue de Madrid, Paris, on Monday and Tuesday, Sept. 5 and 6. At the conclusion of the meeting, alternative visits have been arranged to works in Lorraine, in Burgundy, and in Normandy. There are ten papers on the programme.

ELECTRICITY SUPPLY MEMORANDA.

Dropped Bill and Revival Prospects.

Those who regard the Electricity Supply Bill (No. 2) as essential to the rounding-off of the 1919 Act will take heart from the announcement attributed to Sir John Snell, chief of the Electricity Commissioners, that the Ministry of Transport intends to reintroduce the measure next session, and secure its safe passage. The Ministry may reintroduce, but it can promise nothing—not even with Sir Eric Geddes, the retiring Minister of Transport, the Chairman of the Government's Business Men's Economy Committee. There can be no question about it, the Government are getting genuinely alarmed over the attacking movements that are being made on national expenditure. Warnings to them come from the City, from bankers, and from industrial men and Chambers of Commerce all over the country. Anti-waste candidates have met with successes in the constituencies; and these successes are bringing forward a plentiful supply of candidates to oppose in the next General Election the active or the passive supporters of the Government, the departments of which cannot see their way unaided to cut-down present and new expenditure. To oppose this new phase in the political world, Government strategy has conceived the Business Men's Economy Committee. The Committee are to have nothing to do with policy; but their advice cannot be effective if it does not challenge, and counsel change in, policy in various ways. Every day makes it more needful for the Government to refrain from authorizing new expenditure that can be avoided—particularly for schemes of their own hatching, such as this reorganization of electricity generation. The "Electrical Times" is a little sceptical about the promise of the Ministry of Transport to reintroduce the Bill next year. The promise, in its view, may temporarily strengthen the position of the Commissioners; but it is not likely that the material opposition to the measure will be lessened by the mere passing of time. Our confidence would rather incline to an increase than a decrease of hostility. "Electrical Industries" regards it as unfortunate that joint electricity schemes are being made dependent upon the passing of the Bill; and it does not agree with the assumption that the Bill is essential. On the other hand, the "Electrician" opines that the position has not been made easier by the failure to pass the Bill. The preliminaries to the formation of a Joint Authority will take time; and so, in its view, if (there is as great virtue as ever in an "if") "we could hope to see the Bill, or a modification of it, revived and passed early in the next parliamentary session, no permanent injury would have been done."

Joint Authority Alternative.

We are not prepared to say that the Joint Authority and generation concentration schemes are really wanted for the development of electricity supply in this country. What is required would come about by natural evolution. But assuming Joint Authorities are essential with the powers contemplated by the 1919 Act, then financial authorization is necessary to the performance of statutory functions. The views of "Electrical Industries" are based not upon Joint Authorities as contemplated by the Act, but upon something far different in nature and power, and which we are inclined to think has not statutory countenance or rights. Our contemporary regards it as most unfortunate that joint electricity supply schemes are being made dependent upon the passing of the Electricity Bill (No. 2). That Joint Authorities cannot be formed in any effective way without specific powers to draw upon the rates of constituent members for security of the loans raised by the central authority, "Electrical Industries" believes to be quite erroneous, and the idea is standing in the way of a great deal of useful development. It agrees that some means must be found to finance joint schemes, but submits that it does not follow that the only, or the best, way is to finance them through a Joint Electricity Authority. Then we come to the alternative that our contemporary has in mind. The South-West Midlands scheme has given it the cue. In that case only an Advisory Committee is proposed; and this Committee will have no capital-spending powers. The scheme in this instance is the united product of the Birmingham Corporation and the Shropshire, Worcestershire, and Staffordshire Electric Power Company, who between them supply all the energy, except a relatively small remnant, in the area. That is a totally different thing from several supply authorities being concerned. The more the number of authorities, the greater the complexity; and with a multipart authority, the capital expenditure must be, it seems to us, a joint matter and under proper control, but the rates must be protected. Another thing our contemporary does not wish to see is the industry handed over to bodies which are debarred from taking risks. The views of ratepayers are more important than those of our contemporary. And a thing ratepayers are anxious shall not happen is that risks shall be taken that will increase the call upon their already overtaxed pockets. It is the possibility of risks that clash with the rates. From our point of view, an Advisory Committee, while it may be useful, will only represent something a little (if any) better than the existing conditions; and this is not exactly what was in view when the Electricity Commissioners were called into being.

The London Inquiry.

The inquiry into the reorganization of electricity generation in London has been a spacious affair. It occupied twenty-six days, running over seven weeks. Sympathetic and anxious over the Electricity Commissioners, the "Electrical Review" fervently hopes that the health of the members will not suffer under the strain. Of course, the days were of the torrid order; and this possibly made close application a matter of some difficulty. But we do not expect that this will affect the decision arrived at any more than we anticipate that the Commissioners will have suffered in health. They exhibited a great deal of patience. Despite the heat, the legal luminaries representing the various parties suffered from excessive prolixity; and some of the electrical experts hammered out details to a wonderful degree of fineness. As a result of the inquiry, the Commissioners have before them four schemes upon which to exercise their selective powers—one by the London County Council, one by nine of the London Electricity Supply Companies, one by the Conference of Local Authorities, and one by the Poplar Borough Council. But only the County Council and the Conference of Local Authorities submitted schemes compassing the defined area; the other two schemes contemplate smaller areas, which, in the wisdom of the authors, are regarded as sufficient for initial purposes, and for some years ahead. The financial part of the schemes is the one which will claim most consideration from the Commissioners, and cause them trouble. The London County Council are gloomy as to the outlook. On the other hand, the nine Companies do not see any difficulty in raising £1,050,000 for linking-up before a capital station is built. The Conference of Local Authorities and the Poplar Council look to the rates as supplying a stable foundation for raising the necessary loans. We hope the rates and this method of raising money for electricity generation will be completely dissociated. As to costs, since the estimates were made, the Bank rate has fallen, and the prices of materials and labour have commenced to recede. Nevertheless prudent men urge wariness, inasmuch as the last thing that is desirable is to cumber the industry at the present time with capital stations that a few years hence might be built at a much lower cost. In a recent paper before an electrical association, it was pointed out that the present cost of plant is of the order of £25 per kilowatt, as against £10 to £12 before the war. Another thing that was apparent from the inquiry was that the day has not yet come when there will be a voluntary welding of interests by electricity companies and local authorities. They do not like each other; and this is an obstruction to the formation of Joint Authorities. Such bodies cannot be forced universally upon the supply authorities of any area; they can only come by agreement. Of course, the Electricity Commissioners have the whip-hand, in that they can refuse sanction to capital or loans for plant extensions, and so compel an undertaking to take a bulk supply from a Joint Authority or Power Company, unless the administrators of the undertaking desire to starve it, and so be unable to meet their responsibilities.

The Likely Trend of Charges.

Looking down the accounts of various municipal gas undertakings, it is seen that experiences as to results differ widely in the financial year that ended just before the coal strike. These differences are in some cases due to local conditions of demand, but in the main are attributable to the sufficiency or insufficiency of the price increases that took place during or before the year commenced. In certain places where there are good net profits, part of the surplus is being carried to the relief of the rates, which indicates that consumers are being charged more than they ought to pay. On the other hand, even in important areas, the price of current is going up owing to shortage of revenue. As instances, Edinburgh and Leicester may be cited. The coal strike will, of course, in view of the high expenses incurred in keeping going, again change the aspect of financial affairs. Many undertakings will have to revise prices in the upward direction in order to provide the necessary compensation; but the money that has been transferred to the rates ought in justice, to have been kept in hand to meet the exceptional charges. In some places, consumers are pressing for reductions; but the chances of these are very remote. A prominent uncertainty is the industrial demand. The lighting demand is not great in these "summer-time" months; and several electrical engineers report that simultaneously there has been a heavy fall in power requirements. Opposed to the political prophets who prognosticate a trade revival in the autumn, some electrical men fear that the coming winter will see the industrial demand for energy still on the low side. Of course, some stations are obtaining a partial set-off by economies. Where new generating plant has been installed, there have been reductions in fuel consumption; but still efficiencies are, in cases, nothing of which to boast. At Brighton, the amount of coal consumed per unit generated has improved from 5·27 lbs. to 4·21 lbs. Reckoning the calorific value of the coal at 12,500 B.Th.U. per lb., the lower consumption would represent an efficiency of only 6¼ p.ct.

Suspect.

Timber yards and electric wires and sparking motors are not fit companions. There have been "mysterious" fires before this at timber yards, in which "up-to-date" electrical machinery has been installed. The cause of the great timber-yard fire in the East-end of London early last week has not been

satisfactorily explained. It was at first put down to the escapades of the unemployed who were seeking work, and were supposed to have been foolish enough to have helped to destroy means of creating work, so making further contribution to the army of unemployed. But this theory has been discarded by the owners of the timber yard, who positively assert that they are satisfied the fire was not due to arson or malice. The "Daily Telegraph," reporting on the occurrence and its destructive consequences (the estimate of loss is now stated to be £860,000), says that among the buildings destroyed was an up-to-date saw-mill, which had only just been completed, with costly machinery. Was this machinery electrically driven? Turning to the "Daily Chronicle," we read: "The proprietors are satisfied the outbreak was not due to arson or malice. The fusing of an electric wire is suspected." Much of the timber had been seasoning for thirty years, and never a fire before. But then the "new and costly" machinery had not been introduced. The electrical people soon got the wind up; and the following day it is stated that electrical experts were exploring the place. As might be expected, they scouted the idea "that a short-circuit or the fusing of a wire caused the outbreak." It is wonderful what electrical eyes can detect in the ashes and among the wreckage of a building that has been subjected to intense and devouring flame. According to "The Times" Paris correspondent, there is no uncertainty about the cause of a fire on Aug. 9 at Nantes. "It was caused by a short-circuit, and originated in a furniture factory." It destroyed two factories and two private houses; and partly demolished the Apollo Theatre.

Wasting Money at Hastings

The electricity station at Hastings used to be described as a "white elephant." The Council bought out the old Company's property at considerably more than it was worth, and so were burdened with an enormous initial capital. The white elephant has been nursed and pampered; but it has not shown any serious gratitude. It has caused high charges for electricity for various purposes; it has produced deficits in bulk form; but when it has yielded a small amount of surplus profit, it has been patted on the back, its deficiencies have been temporarily forgotten, and it has been described as being all that is good. The pampering has gone on in many ways. There has been foolishness in the pampering. There is foolishness in the latest happening. A new arterial road is being made; and before it is metalled, it is proposed to lay an electric cable along it. It is "contemplated" that houses will be built—nothing more than "contemplated." There is nothing certain about it. Anyway, there will be the public lighting! The cable, the Electrical Engineer estimates, will cost £2611. The Electricity Committee no doubt want the main laid; but they desire that it shall be done at the expense of the ratepayers. They have therefore proposed that the interest and sinking fund on the cable loan be paid to them by the Council (meaning the ratepayers) until such time as the revenue derived from the supply of current to consumers and public lamps connected with the main is remunerative. How many years before this occurs is not known. The interest and sinking fund that the Council will have to pay over the years before the cable becomes remunerative (if ever it does so) may easily exceed the original capital cost. In a few years' time if the cable is then really wanted, the expense of laying would be largely reduced. Cables (like other materials and goods) and labour will with time be lowered in cost; and then the saving in first expense *plus* the cost of interest and sinking fund from now until the demand becomes remunerative, would make a later-dated cable a much better proposition, notwithstanding cutting through the metalling of the road, which is only a convenient present excuse for doing something somebody wants done. It is going to be a costly cable by the time it is profitable. This is sheer waste, and in days too when there should be the utmost economy. It is of a piece with other absurdities the Hastings Council have committed in connection with their electricity concern.

A Small Requital at Paisley.

"Meteor" of the "Electrical Times" makes editorial point of the Paisley Electricity Department having held-out what he calls a helping hand to the Gas Department to the extent of £3000. Our friend has a short memory. The fact is the Electricity Department has only paid back a bit of its heavy indebtedness to the Gas Department. Looking at our issue for Aug. 12, 1919, it will be seen that the electricity concern had the previous year a balance of £13,478 on the wrong side; and it was calculated that the loss in the then current year would be £11,341—making together £24,819. But it was only proposed to raise the price of electricity sufficiently to bring in £9567, as it was feared a higher price would kill the business. The then estimated deficiency on the gas undertaking was £10,900, which would have been met by 6d. increase in the price of gas. But the gas consumers—the gas consumers!—had the price put up by 1s. 3d. per 1000 c.ft. (9d. more than the gas undertaking needed) in order to wipe-off the shortage of £15,252 on the electricity concern. This stands as one of the biggest scandals in municipal trading and administration. We do not remember that "Meteor" favoured his readers with a note on the subject at the time, nor since; but the beggarly £3000 which only partly repays a big debt is the subject of admiration, which is grotesque when the facts are known.

A GAS COMPANY AS GAS-FIRE ENAMELLERS.

A Popular and Successful Development at Croydon.

WE are living in new times—times when work costs considerably more than our old standards of notion as to what prices should be; times when ideas have changed as to the design of houses, their appointments, and their colour schemes. Gas undertakings have to bow to the inevitable, and have to meet the requirements of their consumers, or they must take the place of "back numbers," and voluntarily inflict an injury on their businesses. This gas undertakings of any standing cannot afford to do. They have to be up to the times and the changes in needs and tastes; and varied as are the ramifications of their business to-day, they must add another and still another branch just as external influences ordain. In doing this, they must see which is the most economical course to take both for their own pockets and those of their consumers; for a study of the consumers' pockets is a great factor in popularity.

THE DEMAND FOR ART-COLOURED GAS-FIRES.

There is a growing demand for gas-fires finished in art colours. This demand has developed with the new class of houses in which coal-grates have been abolished in certain rooms, and tiled recesses or simple tiled backs and hearths are provided for gas-fires. The modern housewife, too, who has an eye for ornate effects wants her gas fire or fires to match the styles of decoration in her rooms. She abhors the black-finished fire that she has, and wants it changed for one enamelled in the appropriate colour. But hitherto she has had to bear disappointment on account of the high cost. The difference in cost between a black-finished gas-fire and one enamelled in an art colour, or with a bronze or armour-bright finish, is to-day very considerable; and this is a drawback to complying with the requirements of the builders or tenants of new houses, or of the housewife who would like to see her gas-fires in a new and more eye-pleasing dress.

A SIMPLE AND ECONOMICAL COLOUR-ENAMELLING PROCESS.

The Croydon Gas Company, stimulated by cost and requirement, have developed a simple and economical process of art-enamelling gas-fires in their own workshops; and it is believed their example will be followed by many other gas undertakings, for several responsible gas officials have heard about what is being done, and have been to investigate the process. The writer of this article also heard of it, and of its growing popularity among the consumers; and the Distributing Engineer and Sales Manager of the Company (Mr. W. J. Sandeman) has kindly shown him the process in operation, and has given him several useful particulars which he is at liberty to pass on to "JOURNAL" readers for the benefit of the industry generally. Mr. Sandeman is enthusiastic over the process and its potentialities. It meets a want. As it becomes better known among the consumers, this branch of the Company's operations will, it seems certain, have to be developed—not only because of its relative economy, but because householders can get exactly what they want from the Company, or have their old fire castings changed from black to any colour, or one colour changed to another, and at an expense which they can afford. This is an important local facility from the business point of view. We emphasize the word "local," because there is now no necessity for sending away fires to manufacturers' works for enamelling to a colour to satisfy requirements; and little time is spent under the new order of things in making the colour change. These are days, too, when gas undertakings have to search for economies; and the Croydon Gas Company find that they can buy fires of black finish, and then durably enamel them themselves by the simple process referred to, and so meet positively the most exacting needs of customers at a cheaper rate than they can buy fires at with coloured enamelled castings.

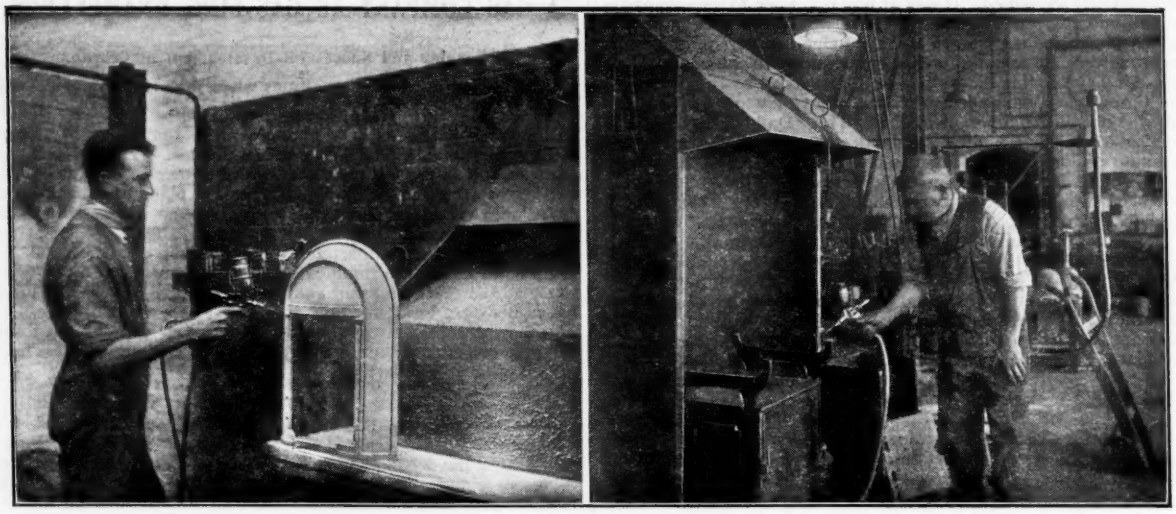
COST TO THE CUSTOMER.

Cost, durability, and a high-grade, clean, bright finish, with time and transport savings, and satisfaction of the consumers are therefore the chief advantages of the process. As to cost, the Company charge the customer 17s. 6d. extra for enamelling in any art colour a selected black-finished fire; the customer simply supplying a tile or a piece of material showing the colour he or she requires, and the match is perfect, as the writer saw by several examples and work actually carried out in his presence. On the very day of his investigation of the process, half-a-dozen orders had been received; and the customers in three cases had sent tiles the colours of which they wanted matched, in another simply a piece of coloured silk cord was supplied, and in the other two cases pieces of fabric. For bronze finishes 25s. above the ordinary prices of the black-finished fires is charged; and for armour-bright, 30s. We also saw a fire finished in old gold, and very beautiful it looked.

The quality of the work is really excellent. By the process a translucent effect is produced; it is not a dead-colour. The tones can be delicate, of full richness, or shaded from a delicate tint to a heavier tone round the outer parts of the framework, as in the popular brown earthenware (or teapot brown) style. The finish is clean, flat, and without any running.

REQUISITES FOR THE WORK.

The equipment required for the work is of a simple character. The fine workshops of the Company's Distribution and Sales



TWO VIEWS IN THE ENAMELLING SHOP—THE OPERATORS AT WORK.

Department are situated near the main entrance to the Waddon Gas-Works; and thither the writer went in the company of Mr. Sandeman.

There is an air-compressor in the shops, which serves several purposes, among them the provision of an air-blast for the application of the colouring preparations in the gas-fire enamelling work. The pressure used is 20 lbs. per square inch. A pistol sprayer, ½ mm. bore, either of the "Airostyle" or "Aerograph" patterns, is used. But the sprayer and the work of matching colours cannot be put into the hands of just any man. The operator must, if satisfaction is to be secured, thoroughly understand colour mixing, the blending of shades, and the extent of darkening due to stoving. Observation also assures us that a skilful handling of the sprayer and an artistic eye are requisites to the obtaining of those gradual shadings-off of colours which so materially add to the effect of the finished treatment. Then again, temperatures and duration of stoving have to vary with the colour and nature of the preparations. Usually the lighter the shade, the lower the temperature, and the longer the period of stoving; the deeper the colour, the higher the temperature, and the shorter the time. For example, in obtaining the setting of the first coating, the stove has to be exposed to a temperature of from 180° to 260° Fahr.; for the finishing work in delicate colours, a temperature of from 180° to 230° may be preferable; but for deeper colours the temperatures may run up to about 300°. About one-and-a-half to two hours are required for the stoving, depending upon the colour and the tone. The operator has to judge of the degree of his spraying, so as to make due allowance for the change in tone that will result during the stoving. Thus the need for proper training, and the securing of a man who has particular aptitude for this kind of work. Knowledge of the pigments, the skill of the operator in hand and eye, and appropriate temperatures, are important essentials in this work; and each (but in varied degree) contributes not only to appearance but to durability.

The durability of the enamel is great. It was noticed that while it is possible to scratch it by applying a knife or other sharp instrument or to make a mark by striking the surface with a hammer, there is no chipping-off of pieces of the enamel. A plain scratch or surface injury which can be easily put right is all that results. The writer saw the whole process applied to a stove black-finished by the makers which was to be made to match a green tile. In the end, the tile and the stove compared looked as though they had been subjected to the same treatment, and at the same time. Many other samples of work were seen; all were in tone scrupulously exact to pattern. Among them was examined a stove finished in black "ironite" over the makers' black finish. There was the same translucent effect; and a test proved the permanence.

One point in working economy is that, when possible, time is saved by doing as many fires as possible in one colour.

It was noticed that the appearance of art-treated fires is enhanced, and protection from heat is given, by introducing short brass fender strips on the casing opening in front of the radiants.

Hints as to Treatment.

Each type of finish may now be taken separately, and information be given as to the process followed:

Bronzing Process.

(*a*) Thoroughly clean, sand-blast (usually), and polish fire to "armour bright" standard.
(*b*) Apply a coat of stoving lacquer.
(*c*) Stove.
(*d*) Apply a coat of clear varnish.
(*e*) Finally stove.

Art Enamelling (Delicate Finishes or Pale Shades).

(*a*) If the fires are new, and have nice smooth finish, apply over the black a white priming. The preparation used is Ingham, Clark, & Co.'s special zinc base white undercoating, as made to the Company's specified requirements. [*Note:* When a colour has to be matched with a tile, the colour of the priming can often be detected from the edge of the tile.]
(*b*) If the fires are second-hand or of rough finish, thoroughly clean the casting; and, if needed, sand-blast. If necessary, fill the pores with a mercury filling. This is seldom required—only if castings are porous. Apply priming as for "*a*."
(*c*) Stove undercoating for two hours at about 180° Fahr.
(*d*) Apply finishing preparation, consisting of Ingham, Clark, & Co.'s white finishing enamel, to which is first added a pigment to produce the required tint.
(*e*) Stove for about two hours at (say) 180° Fahr.
(*f*) Apply a final coat of a slightly deeper tint of finishing preparation around the canopy and at sides, where the heat is most acute. This gives the desired gradations of colour, and deepens the shade at the most likely points of possible discoloration.
(*g*) Finally stove.

Art Enamelling (Rich Finishes—Full Green, Red, Brown, and Blue).

(*a*) If the fires are new, and have nice smooth finish, apply over the black a priming (Ingham, Clark, & Co.'s) of a lighter shade than the desired "finished" colour—say, pale dull green, light dull red, pale "cold" brown, and blue.
(*b*) If the fires are second-hand or of rough finish, thoroughly clean casting; and, if necessary, sand-blast. Fill the pores with a mercury filling, if necessary. This is seldom required—only if castings are porous. Apply priming as for "*a*."
(*c*) Stove.
(*d*) Apply finishing preparation, consisting of a mixture of a pigment and varnish (made up to suit the desired shade).
(*e*) Stove.
(*f*) Apply a final coat of a slightly deeper tint of finishing preparation around the canopy and at sides.
(*g*) Finally stove.

We have seen and are satisfied that the Croydon Gas Company have made an important development in connection with this gas-fire art enamelling work. It is going to be a good auxiliary in business promotion through economically, promptly, and satisfactorily meeting the requirements and tastes of consumers in this direction.

Manufacture of Heat-Treated Products.—Bulletin No. 230 of the W. S. Rockwell Company, of 50, Church Street, New York, consists of a series of papers containing a good deal of useful matter on the subject of "Heat-Treated Products." There are in all five papers, which discuss factors governing quality and cost of heat-treated products; relation of temperature control to uniformly heated products; selection of furnaces; relation of price of fuel to cost of production; and the influence of furnace design on the quality and cost of the product. The papers are technical in character, and have been prepared to develop a better appreciation of the factors governing heat application and heat utilization which it is thought by the firm are generally overlooked or misunderstood in practice, though vitally linked with the quality and cost of heat-treated products and the utilization of fuel resources. Each paper is accompanied by a diagram, to assist in the elucidation of the points raised. The subject is one with which the Company, who are furnace engineers and contractors well known in the United States, are well qualified to deal, with advantage to readers. With the articles the firm forward a handy steel heat-treatment chart, embodying in compact form the factors ordinarily involved in the process, and showing on the reverse side melting points and various conversion equivalents.

REPORT OF THE LIFE OF GAS-METERS JOINT COMMITTEE.

There has now been released for publication the report of the "Life of Gas-Meters Joint Committee" which will be submitted at the postponed annual meeting in October of the Institution of Gas Engineers.

There are five sections in this report: (1) The continued investigation into chemical and physical causes of internal corrosion. (2) Report on the lubrication of meters by spraying, and the effect on meters of introducing oil vapour into the mains. (3) Comparison of notes with a similar Committee of the American Gas Association. (4) The work of the Committee in reference to the amendment of the Sales of Gas Act. (5) The tabulation of new standard sizes of meters with revised denomination.

Section 1.

The corrosive influences of certain constituents of coal gas and water gas were fully detailed and described in the previous reports. These constituents are notably hydrocyanic acid, salts of ammonia and carbon bisulphide, oxygen, carbon dioxide, and sulphur dioxide—all harmful in the presence of moisture. Correspondence has been maintained with engineers who have found corrosion deposits in mains, services, and meters, and meanwhile laboratory experiments have been continued. In these experiments, the conditions of corrosion have been reproduced, and attempts have been made to find a remedy and the simplest means of prevention.

Corrosion of Station-Meter Drums.

Blue Water Gas may easily be a cause of trouble, if it be allowed to go forward with an acid reaction. Carburetted water gas is only neutral when the blue gas is carburetted to the extent of 1½ to 2 gallons of oil per 1000 c.ft. Even then, it depends upon the amount of sulphur both in the coke and the oil.

Purification.—It is essential that oxide used for the purpose of purifying blue gas should have an alkaline reaction such as may be produced by adding slaked lime. It has been objected that the mixing of slaked lime with oxide would cause back-pressure; and therefore it is suggested that one tier only of each purifier (next the inlet) might be occupied entirely by chalk broken into small lumps, and possibly mixed with breeze to keep it open. The chalk would absorb the SO_2 in the gas, give up an equivalent of CO_2, and would not absorb the CO_2 going forward with the blue gas.

Artificial Oxide should only be used after careful analysis. Certain samples of raw artificial oxide have been found on analysis to contain over 15 p.ct. of calcium sulphate, nearly 1 p.ct. of ferrous sulphate, and as much as 1½ p.ct. of free sulphuric acid.

The SO_2 which comes forward as an impurity in blue water gas can be taken out by washing with a solution of soda ash, or in certain cases can be passed into the coal-gas foul main, where it goes forward through washing plant containing an alkaline solution. It has been pointed out previously that carburetted water gas contains ammonia due to the cracking of nitrogenous bodies in the oil, and that this ammonia tends to neutralize the SO_2 and so to render the carburetted water gas harmless.

Deposits in Works Mains.—Communications have been received in regard to supposed naphthalene or corrosion stoppages in works; and the question has been asked whether vaporizing paraffin oil would be a suitable remedy if applied at the inlet to the washing plant or purifiers. The trouble is probably due, not so much to naphthalene, as to "cracked" tar (caused by high heats) leaving carbon deposits in the works mains, and possibly the drawing-in of too much air or furnace gases through defective retorts. The gas is evidently extremely "dry;" but it would not be wise to attempt to lubricate it on the works by installing a petroleum vaporizer before the purifiers, as this would interfere with the efficiency of the oxide.

Temperature and Condensation have been mentioned repeatedly as essential physical conditions influencing the problems of internal corrosion. High-pressure distribution, which appears to aggravate the trouble, also provides the remedy; for the gas can be raised to a pressure above that required for distribution, and then cooled and condensed before expansion into the mains.

Location of Meters is a matter of the utmost importance, having as direct an influence for good or ill on the registration and life of a meter as imperfect purification of the gas. If meters are placed in cold, damp, or draughty places, they should be carefully covered-up and protected. No meter should be exposed in a position where it is likely to act as a condenser. Inspectors should be required to report on all such locations, and also to note any signs of external corrosion. The casing of a low-pressure meter has to withstand considerable internal pressure when gas is supplied at only 4 in. water gauge; and there will be a tendency to break through at any weak place in the tinplate stamping which may be thinned by corrosion.

Wet Meters.—Some cases have been investigated of serious corrosion taking place in consumers' wet meters. This has been found to be mainly due to HCN, NH_3, and CS_2, also excessive CO_2 in the gas, and SO_2—the latter indicating blue water gas insufficiently purified. Apart from the remedies applicable to the purification of the gas, it is recommended that in cases where such trouble is experienced the water in wet meters—both on consumers' premises and at works—be periodically changed completely. Otherwise it becomes not only impregnated, but concentrated as a solution of corrosive salts. In regard to station meters, it is usual to keep a small stream of water running through; but the overflow pipe should be conducted from the bottom of the meter, preferably on the opposite side to the inflow (diagonally), so as to make the circulation as complete as possible.

Corrosion of Metals.—Tests were mentioned in the previous report on alloys used, or proposed for use, in the construction of meters. These have been continued as follows: (1) Metal partly immersed in a solution kept saturated with CO_2, and intermittently exposed to air for about a year. (2) Metal immersed in a solution containing salts produced by the interaction of CS_2 and NH_3 for a similar period. Of the metals tested, ordinary tinplate showed the least resistance. It was badly pitted by (1), and entirely disappeared under (2). Plate coated with lead or with an alloy of zinc and tin showed much better results; and some special metals—such as Armco (pure) iron, coated with an alloy of lead and tin—came through the tests in very fair condition. Aluminium was unaffected.

Hydrocyanic Acid (HCN).—In the previous report it was stated that for the elimination of HCN there is still lacking a simple process suitable for adoption by the smaller gas undertakings, and in this direction experiments were being continued. After numerous attempts, more or less successful, but none leading to a process sufficiently simple, a method has been tried which has given excellent results in the laboratory. It is hoped that fuller information will be soon available.

Section 2.—Spraying Meters.

As a method of lubrication and protection, the process of spraying was suggested at the special autumn meeting of the Institution in 1918; and the Committee have now thought it advisable to make inquiries as to the extent to which this has been adopted,

and with what success. It has been ascertained that between 100 and 150 gas undertakings have installed plants for spraying, either by hand or machine pump; and a number of circular-letters have been sent out by the Secretary, with a sheet of questions. These inquiries have been framed partly to draw conclusions as to results beneficial or otherwise, and partly to ascertain how results are influenced by the method of procedure. Much depends on the oil used and the quantity. The following is the specification recommended: A mineral oil of high boiling-point, with a specific gravity not less than 0·85 (preferably above), and which shall not ultimately leave a gummy residue. The work of the oil-spray is not only to clean and lubricate the slide-valves, but to maintain the suppleness of the diaphragms, and to coat the interior of the case with a protective film. A really heavy oil of the paraffin series will achieve these results; but obviously it must not itself polymerize and leave a sticky residue. A lighter paraffin should be avoided, because it might tend to wash the dressing off the leathers and the grease from the stuffing-boxes. The oil-spray should not be too "wet." In adjusting the nozzle there should be sufficient air for atomization.

The following are the questions and their answers:

(1) (*a*) Do you spray meters that come in defective through "sticky" valves?
22 engineers replied, "Yes."

(*b*) Do you spray repaired meters before sending out?
14 engineers replied, "Yes."

(*c*) Do you spray new meters before sending out?
5 engineers replied, "Yes."

(*d*) Do you spray meters on the district *in situ*?
Only 4 replies, two propose to do so, one does "occasionally," and one sprays noisy meters successfully.

(2) Do you use a heavy paraffin oil (sp. gr. not less than 0·85), such as solar oil used for gas making, and which leaves no gummy residue?
15 replied "Yes." One uses "olive oil after many experiments," another gas-engine oil, another neats foot and paraffin (equal), several an oil of sp. gr. 0·88 to 0·90 supplied by Messrs. Alexander Duckham & Co., and several use solar oil as recommended.

(3) Have you found many cases where meters that are incorrect have been put right by spraying?
17 replied "Yes," with remarks as follows:—"Yes, the majority of cases even up to 30 p.ct. slow." "Yes, a fair number." "Over half corrected by spraying." "Meters registering slow can generally be brought up to 2 p.ct. or 3 p.ct." "Out of 1885 meters which were defective, 549 proved correct after spraying."

(4) Have you found any marked diminution in your meter repairs traceable to spraying?
8 answered "Yes" and one remarked "No, but spraying has made it unnecessary to repolish the valves of a number of meters."

(5) Have you noticed any diminution of your unaccounted-for gas which could be credited to spraying meters?
Only one replied in the affirmative. Others remarked that it was premature to detect same, or that both this question and No. 4 were complicated by the extra meter and other troubles arising out of the war conditions.

(6) (*a*) How many 5-light meters can you spray with 1 gallon of oil?
Answers. 85, 400, 40, 900, 144, 400, 32, 32, 24, 400, 380, 96, 150, 160, 320.

(*b*) How many cubic feet of oil-spray do you pass through the meter?
Answers. 1 or more revolutions, 2½ c.ft., 2 revolutions, 10 c.ft., 6 c.ft., 2 c.ft., 2 to 6½ c.ft., 40 c.ft., 4 c.ft., 10 revolutions, 20 c.ft., 2 c.ft., 3 c.ft., 2 c.ft., 3·75 c.ft., 10 c.ft., ½ c.ft.

(7) If you atomize or vaporize paraffin burning oil (such as Royal Daylight) into your mains, are you able to trace any benefit to consumers' meters thereby?
15 replied "Yes," with the following comments:

"We have for many years past used paraffin oil extensively for spraying into our mains for the prevention of naphthalene. As a result we have had no trouble with our meters which would have made it desirable to spray them with heavy oil."

"We have been atomizing and vaporizing paraffin oil and also ordinary gas oil into our outlet gas regularly for the past 12 years, for naphthalene elimination, and have also found the meter diaphragms in an oily condition as a result."

"After the naphthalene has been cleared from the mains, I prefer a heavy petroleum (such as a heavy gas oil) and have resorted to this latter for the past 7 years. Our practice has been to use this heavy gas oil in a combined vaporizer and atomizer on the inlet of the works governors."

"We have only been vaporizing 6 months. It has certainly cured naphthalene troubles, and we have found traces of the oil in meters and hope to find a less percentage needing repair."

"Yes, certainly."

"Since vaporizing we have found decided improvement in distribution and less complaint by consumers."

"My experience points to a very material benefit arising from spraying and vaporizing paraffin into the mains."

"Not only a decided benefit to meters, but it has done away with naphthalene trouble. The paraffin also assists the diaphragms of meters."

"We have recently examined 10 meters brought in from the district. In every case the leather diaphragms were quite flexible and a large amount of lubrication was still contained in the leathers. Four of these meters had been in continuous use since 1907, and two since 1909. Some of the meter cases below the diaphragms contained a quantity of oil."

"Atomizing paraffin oil into the mains has a beneficial effect on consumers' dry meters by reducing the amount of condensation therein. There has been a notable improvement in the condition of the meters during the last 18 months."

(8) Have you any reason to think that the lubrication of meters, either by direct spraying with heavy oil or by passing a lighter paraffin vapour (as No. 7) into the mains, has any detrimental effect?
24 answer "No," with comments as follows:

"On the contrary a beneficial effect all round."

"As regards sticky valves the treatment by spraying has been quite successful."

2 engineers answer "Yes." The one qualifies as follows:

"The writer is of opinion that any cleansing oil is detrimental to the life of a meter, as it perishes the dressings of the leathers."

The other refers to "the enormous number of meters that have to be exchanged in consequence of leaky stuffing-boxes."

[Inquiries that have been made seem to indicate that the complaint of leaky stuffing-boxes is confined to this particular gas undertaking.]

One engineer has found that excessive spraying or vaporizing of oil in mains in a naphthalene emergency has caused an undue accumulation of oil in meters and restricted the action of the diaphragms.

Communications which have been received from two of the meter makers who are represented on the Committee express anxiety about the effect of oil on diaphragms and stuffing-boxes, and lay stress on the preference for a heavy oil for spraying. As to the immediate effect of spraying on the test of a meter, both remark similarly as follows:

"The tests after spraying are quite different from the tests before."

"The effect varied so greatly that we discontinued the practice."

To explain this, it may be pointed out that the errors of a meter may arise from several causes. For example, if the leathers have become hard and stiff, the meter will have a tendency to register fast; while if the valves have become worn or dirty, the tendency will be to register slow. The net result may be either on the fast or slow side. Spraying may correct all the errors of the meter, or it may correct only a part. Hence the test that follows may fail to evidence the benefit received.

In conclusion, the following general remarks are quoted from two engineers who have favoured the Committee with their experiences:

1) "The standard quality of gas supplied here is 550 B.Th.U. It would appear that the above quality of gas is not specially harmful to the meter. Of course the diaphragms crack more readily than they did with higher quality (600-620 gas); but I think it is in part at least due to the inferior quality of the leather supplied during war time."

(2) "We have invariably used a certain percentage of oil in our water-gas plant; and our meters are therefore not so dry as in many districts where they have been mixing the ordinary blue gas. I consider that carburetted water gas helps to keep the meters in order."

Concluding this section of the report, it may be noted that there is considerable experience over a number of years to indicate that the need for spraying meters may be considerably less where the distributing system has been well impregnated with oil vapour by atomization, or by introducing oil vapour into the mains.

References to American practice in spraying meters will be found among the extracts quoted from reports of the Special Committee of the American Gas Association.

Section 3.—American Reports.

The Committee are indebted to the American Gas Institute for copies of reports issued by their Special Committee on Consumers' Meters. Some brief extracts are given from these reports touching many points of interest where American practice and experience differ from, or perhaps confirm, practice and experience in this country.

Apparently there is no enactment in the States equivalent to our Sales of Gas Act, so far at any rate as Federal legislation is concerned. The reports are therefore taken up with a considerable amount of detail in regard to the testing, setting, and repair

of consumers' meters. More recent problems in regard to deterioration have also received attention; for it is evident that the influence on meters of the composition of gas has produced experiences parallel to those which have been considered by our own Committee.

In American practice, meters are tested at two rates of flow, which they term "check" and "open." "Check" means the rated capacity of the meter; and this is regulated by passing the gas through a given orifice at a given pressure. There are orifices standardized for each size, and called "check caps," to be placed on the outlet of the meter. The inlet pressure is 15-10ths; and sometimes the rated capacity for the "check" test is estimated by the average quantity of gas which meters of a given size will pass with an absorption of 3-10ths differential pressure. The "open" test refers to the meter working at the same inlet pressure with open outlet.

EXTRACTS FROM THE 1910 REPORT, ENTITLED THE "ACCURACY OF CONSUMERS' METERS."

Accuracy at Different Pressures.—Meters in which the valves are properly set will register with the same degree of accuracy the passage of air or gas through same at different rates of flow, provided there is no leakage in any part of the meter.

Index Testing has been discussed but not found to be necessary. No instance is recalled of incorrect gearing.

Air and Diaphragms.—Meters removed from service should be tested as quickly after removal as is consistent with the time required for the meter to acquire the temperature of the proving room. Too much emphasis cannot be placed on the importance of immediately capping or corking the pipes, or tubes, upon disconnecting the meter at the consumers' premises, as the action of the air entering the meter may cause a change in the proof.

Saturated Gas.—There is a good deal of reference to the necessity of gas or air being saturated before passing through meters under test; and it is the practice to cover the water in test holders with oil. There are also meters called "dipping" meters, in which a bath of oil is held at the bottom of the case for the diaphragm to dip into. It is not at all clear that this practice is successful; for it is stated that these meters prove slower on the average than non-dipping meters.

The Quality of Gas and the temperature conditions are important factors affecting the proof of the meters in service. Meters which are required to pass coal gas are subjected to less variations than are meters through which pass a mixed gas, a water gas, or an enriched oven gas.

Effect of Gas and Temperature.—The meters that are adjusted to the greatest degree of accuracy previous to being placed in service are subject to wear of moving parts, deterioration of diaphragms, effect of condensation and impurities in the gas, and the effect of temperature variations, all tending to affect the accuracy of registration.

The summaries of all meter tests for a year in practically every instance show the net error to be slightly slow, averaging about 1 p.ct. sgainst the gas companies. When the results of tests are tabulated according to years of service since previous test, the net error consistently becomes slower as the length of service increases. One large company started a record of meter tests arranged according to years of service. After seven years of service, the net error slow increased rapidly, showing conclusively that meters should be changed at the end of seven years, in order to protect the company against serious loss.

EXTRACTS FROM REPORT OF COMMITTEE ON CONSUMERS' METERS, 1916.

How Often Should a Meter be Brought in for Test?—The more this subject of bringing in meters for what is known as "Change for Age" is investigated, the more apparent it becomes that no general rule can be made which will apply to all companies or even to all the meters of the same company. It is apparent from the information and statistics obtained that the length of time that a meter may be safely left in operation depends upon not only the kind of gas used, but upon its location.

Different Gases.—The first table submitted will be the results of "Age Tests" on 391,469 meters; these tests being arranged according to the nature of the gas manufactured. It would seem as if these tests show conclusively that certain kinds of gas do not have as deleterious effect on meters as others; the meters being used with natural gas standing up the best, while those used with a mixture of enriched water gas and coal gas show the poorest results.

Different Locations.—Another table is given to illustrate the effect of location on the registration of meters. Of those brought in for non-registering, not passing gas, or unsteady lights, the following are the proportions:

From—	
Hot cellars	24
Cold cellars	20
Other damp and draughty places	26
Halls	21
Apartments	9
	100

Slot Meters.—The next tables show that the larger sizes of meters have a tendency to register more correctly than the smaller sizes. In these tabulations it will be noticed that the 3-light prepayments seem to register more correctly than some of the other sizes. This is due to the fact that the prepayments are located inside the apartments, which confirms still further that the location of the meter is of a great deal of importance. There is a wide variation between the accuracy of the 3-light prepayment and the 3-light regular.

Age and Slowness.—The investigation would have a tendency to show very nearly the true condition of the consumers' meters as a whole. The correct and slow meters are greatly in excess of the fast meters. The fast meters tend to decrease, and the slow meters to increase in proportion as the number of years in service increases. The average fast error does not increase with the length of service; while the average slow error constantly increases during each succeeding year.

Ten Years' Limit.—Judging from available data, ten years would appear to be sufficiently long period of time for any gas company to be satisfied to have its meters remain at a consumer's premises without having determined the proof of the meter.

Air and Diaphragms.—Different gases produce different results on the action of the diaphragms. One thing which is most important is capping the inlet and outlet of a meter when it is disconnected, and not permitting air to come in contact with the interior mechanism of the meter. This matter, it appears, has been given very little attention in the past. Some gases leave a sticky condensate in the meters; and as this condensate comes in contact with the air it becomes thick, frequently causing the valves to drag and operate with difficulty, and sometimes sticking the leather of the diaphragms to the side of the meter so as to cause it to tear when it is attempted to pass gas through the meter. With other kinds of gases, the action is such as to remove the oil with which the diaphragms were originally treated; and when the meter is removed and air admitted to the interior of the meter, it frequently causes the leather of the diaphragm to shrink and become hard and stiff, thereby causing the meter to become what is known as a "fast meter," and sometimes to "fail to pass gas." It is unquestionably bad practice to remove a meter from the district and allow it to remain in the shop in an unused condition for any length of time before refixing. If the meter is to be refixed, it should be done as soon after the disconnection as possible, and a minimum amount of air allowed to reach its interior.

Idle Meters.—Meters left in position with the gas shut-off are subject to more severe conditions, both externally and internally, than are the meters in service. The exterior is subject to greater damage from accidents and rusting; the valves tend to stick; and, in turn, to strain the flag-arms and valve-arms when gas is turned on; and the air which works back into the meters after the gas has been shut-off has a tendency to hasten the deterioration of the leather diaphragms.

Pressure Absorbed.—The statement of the capacity of meters should be at a differential of 0·5 in., as all meters can be safely and satisfactorily used at this differential. (Sp. gr. of gas taken at 0·55.)

The Smallest Capacity recommended by the Committee is the 5-light meter.

In the Case of Large Meters, where it is usual to instal a bye-pass for use during repair, the following alternative is suggested. In place of the large meter, a battery of smaller meters whose total capacity is in excess. These can be taken out for repair one by one, and the duty taken up by the remainder.

Location.—It may not be amiss to mention a few of the places where a meter should not be set. There are some rules for the setting of meters that are apparently so necessary to conform to (or, rather, not to conform to) that it hardly seems requisite to make rules governing them—such as the desirability of not setting meters in cold or draughty places, or rooms where there are sudden and extreme changes of temperature, or where they are liable to be in the way and easily damaged. It is undesirable to set meters in bathrooms, coal bins, slaughter houses, stables, or ice-cream manufacturing plants.

Meters as Condensers.—A greater part of the condensate which accumulates in the meter seems to be due to the fact that the meter acts to a certain extent as a condenser; the interior channels of the meter forming traps. Consequently, the meter should not be placed where either the front or the back is subject to draughts or extreme variations in temperature.

EXTRACTS FROM REPORT OF THE CONSUMERS' METERS COMMITTEE, 1919.

All Meters should be Capped immediately upon removal from service, and remain capped up to the time of testing. After final test, meters should remain capped until return to service. The Committee recommend that tin caps, with a sealing washer, be used for this purpose, and that manufacturers be requested to deliver meters similarly capped.

Meter Sizes and Nomenclature.—The Committee recommend that no change in the present nomenclature be attempted, but that the capacity at 5-10ths in. differential and the maker's number be placed on the front gallery of all meters. A minority report recommending a change in nomenclature based on capacity of meters, rather than the present light schedule, will be submitted in connection with this report.

Spraying Meters Internally with Oil.—The Committee considered this question somewhat at length, and received verbal reports of experiments conducted by three of the largest companies. One company reported good progress in stopping slow-motion leaks; another that the sticking of valves to their seats while the meters remain in O.K. stock was prevented. Also it seems possible that the effect of spraying tends to prolong the life of the diaphragms. The Committee feel that further experiments and study should be devoted to this question before definite recommendations are submitted, and will turn over to next year's Committee all data collected.

Chemical Committee.—It was recommended that the co-operation of the Chairman of the Chemical Committee be requested in determining whether some change in the process of manufacturing gas could not be effected to prevent the deposit of condensation and sulphur compounds in meters.

EXTRACTS FROM REPORT OF THE CONSUMERS' METERS COMMITTEE—A.G.A., 1920—COVERING THE TESTING, HANDLING, AND MINOR REPAIRING OF DRY GAS-METERS.

The Meter Connections should be capped immediately upon removal at the consumers' premises. Tin screw caps fitted with newsboard discs are recommended. The caps should remain on the screws until the meters are about to be connected to the prover for test, and should be replaced between the several tests, if these do not follow each other

promptly. They should be replaced securely before placing the meters in O.K. stock. The openings in flanged-connection meters should be closed by means of cardboard or thick oiled paper bolted between the flanges.

Temperatures of Meters.—Meters received from service should be placed in the room in which they will be proved, to acquire the temperature of the surrounding atmosphere. Meters waiting to be proved should be kept off the floor, and not piled too high. They should not be subjected to any sudden changes in temperature or to any influence tending to raise or lower their temperature above or below that of the air in the immediate vicinity of the provers.

They should be given the proof test not later than the next working-day, and, as a general rule, not until five hours after they are placed in the proving-room. If the outside temperatures have been below freezing during the time the meters have been in transit between the consumers' premises and the proving-room, they should remain in the proving-room over night before being tested.

Test for Unregistered Gas.—Apparently the slow test which has been tightened-up somewhat in our new Board of Trade regulations is much more drastic in these recommendations. Meters of all sizes are required to register throughout a complete revolution when passing gas at the rate of ½ c.ft. per hour.

The Slow-Motion Test is most important, and should be made with care, otherwise its value may be lost and meters set with inside leaks.

Spraying.—If after the slow test has been made the test hand has not moved the required distance, but shows some movement, the meter-valves should be thoroughly sprayed with oil and the test repeated.

Test for Soundness.—A pressure of 9 in. water column is recommended as being sufficient to indicate the existence of any leaks without subjecting the seams and stuffing-boxes to unnecessarily high pressures, tending to cause leaks that otherwise would not develop during the life of the meter. If any company desire to use a high pressure, the Committee have no objection to offer. The pressure, however, should in every instance be at least twice as great as the maximum pressure to which the meter will be subjected while in service.

Spraying Meters.—The meters removed from service, and which are returned to O.K. stock, should have the contact surfaces of their valves and seats oiled with a light mineral lubricating oil of good quality. For this purpose the No. 4 neutral, or special meter oil as ordinarily employed for the purpose of making meters "dipping," will be found satisfactory. The application of this oil to the valves and seats is recommended, mainly, to prevent the valves from sticking while the meters are standing idle in O.K. stock, and later showing up as meters through which the gas will not pass. The valves should be sprayed with oil earlier in the order of tests if the meter fails to pass the slow-motion tests, or the action is irregular. The use of air under high pressure is recommended for continuous spraying during at least four revolutions of the tangent, such revolutions to be caused by the air and oil fog. The air and oil spraying nozzle should be inserted in the inlet column, and the spray directed into the long channel. If high-pressure air or gas is not available, the valves may be oiled by means of a long nozzle syringe operated by hand, and so constructed as to direct two fine oil streams followed by a dense oil fog from the nozzle through the forked channels to the under-surfaces of the valves. The syringe should contain only a small quantity of oil and a very much larger volume of air; so that the air following the oil will atomize it and force an oil fog against the valves and over the valve-seats. No definite recommendations can be made at this time as to pressures and spraying apparatus. The practice is comparatively new in this country, but has been pretty generally adopted in England during the past two years or longer. Methods may be worked out in the various situations and the American Gas Association advised of any which are thought to possess merit and have been successfully applied in practice.

Meter Diaphragms.—Small brass badges, soldered on the front gallery plate of the meter, to show the date of new or renewed diaphragms, are recommended.

Limits of Error.—2 p.ct. fast or 2 p.ct. slow error in proof is as large as any company should accept for the O.K. limit of meters upon their removal from service, or of meters about to be placed in service. In determining the so-called O.K. limits, ample consideration should be given to the fact that the general tendency of meters in service is to become progressively slower; and, in consequence, the limit of fast error should be at least as large as that permitted for the slow error, or even slightly larger. In support of this statement, attention is called to the fact that the gas is measured at the consumer's premises under pressures in excess of those under which it is consumed, and generally at temperatures considerably lower than those acquired before it reaches burners or appliances.

Testing of Meter-Index Mechanisms.—Routine tests of index mechanisms should not be required, as experience has shown there is no justification for this practice. In corroboration, attention is called to the discontinuance of the practice in Manchester, England, after fourteen years' experience.

Inspirator for Raising Pressure of Gas or Air.—If high-pressure gas or mechanical means are not available for raising the pressure, this may be accomplished by means of a home-made injector operated by city water pressure. Such an injector is termed an inspirator, and for operation depends upon a small jet of water to entrain the gas or air in its passage through a throat consisting of a short ½-in. nipple. By this means the gas or air at the outlet of the inspirator is raised to a pressure far in excess of the pressure required; and it is necessary to reduce it by means of a medium high-pressure governor.

Stuffing-Boxes, Packing of.—The recommendation to repack leaking stuffing-boxes warrants a short description of the process. In the first place, only a wool yarn of very good quality, having plenty of elasticity, should be used. This yarn should be saturated, so as to increase its weight 100 p.ct., in a hot mixture of materials of a lubricating nature capable of resisting the solvent action of the gas vapours. For this purpose, beeswax and refined tallow have been employed for many years. Other materials may be added, such as light lubricating oil, graphite, petroleum jelly, and small quantities of ivory soap. The Committee are not prepared at this time, however, to recommend any particular mixture.

Effect of Proof Resulting from Oiling Meter-Valves.—A number of experiments were made by a member of the Committee to learn what effect on the proof of meters brought in from service resulted from the oiling of the valves by means of oil sprays, or oil fog, introduced into either the meter-inlet or the meter-outlet. The results show the tendency of the oil to clean dirty valves, and to remedy leakage at the valves. No deduction could be made, however, as to what the effect would be when such meters with the oiled valves were returned to service, or how long the oil would remain on the valves and seats. Another test was conducted as follows: Fifty 5-light cleaned-valve meters, connected in battery in the meter repair shop, were required to pass equal volumes of gas (about 49,000 c.ft.) during a period of one year. Each alternate meter had its valves sprayed with No. 4 neutral machine oil every third working day during the year. The meters were proved with saturated gas immediately upon removal; the prover employed for the purpose having previously been located alongside of the battery of meters. The average proofs of the meters before and after being in service and the effects on proof attributable to the oiling of the valves, were found to be as follows:

	25 Meters. Unoiled Valves. P.Ct.		25 Meters. Oiled Valves. P.Ct.
Proof when set—			
Average.	−0·084	..	−0·292
Proof when removed—			
Average.	−0·690	..	+0·060
Change in proof . .	0·606 p.ct. slower		0·352 p.ct. faster

The total effect, due to the frequent application of oil to the valves was to cause the average proof of the oiled-valve meters to become about 1 p.ct. faster than the average proof of the unoiled-valve meters.

Co-Operation of the Chemical Committee.—In view of the greatly increased troubles experienced during the past two or three years, resulting from the condensates deposited in the meters, producing stuck valves, slow errors in registration, works catch, and defective meters, together with rapid destruction of the diaphragm leathers in meters operated under manufactured illuminating gases, which condition is not attributable to any recent changes in manufacturing methods, the Consumers' Meter Committee again suggest an investigation by the Chemical Committee to determine the causes and the remedy if possible.

Temperature.—Experience seems to indicate that but little damage is done to the sheepskin diaphragms when the meters are kept at temperatures as high as, or higher than, those of the gas passing through them. Expressed in another way, the light oils absorbed from the gas by the oil in the diaphragm leather or in the bottom of the meter do not have a destructive action on the leather. However, if the light oils and water vapour are condensed and deposited in the meters, the trouble begins, and before very long the portions of the leather dipping into the condensate become hard and in many instances disintegrated.

Ammonia.—The presence of ammonia in the gas is thought to be responsible for the small brass parts becoming brittle and losing their strength.

Sulphur.—The presence of sulphur compounds as they exist in the gas in the form of vapour does not appear to injure the diaphragms, or the tin plate, or to cause corrosion of the brass or other metal parts. When sulphur compounds have been condensed into liquid form in the presence of water, they apparently decompose, forming other compounds that do seriously injure the diaphragms, and have a decided chemical action on exposed solder surfaces, causing a black deposit to form.

Ammonia and Cyanogen in the gas are thought to be responsible for the rapid corrosion of the long channels and valve chambers, and to a lesser extent the table and columns. The presence of substances in the long channels, valve chambers, and columns, having the appearance of iron oxide, is believed to be due to the action of the above impurities rather than to any iron dust or oxide carried by the gas into the meters.

The Committee may not be right in the above chemical deductions; but they are made for the benefit of those who may be in a position to investigate the subject thoroughly. The Committee desire, however, to express the opinion that a gas condensed before reaching the meters to the lowest temperatures to which it will be subjected in the consumers' meters, will cause but comparatively little damage to them.

This report concludes with some detailed instructions regarding the setting of valves, so that there may be no variation in the accuracy of meters when tested at different rates ("check" and "open" proofs).

Section 4.—Amendment of Sales of Gas Act.

The necessary alterations to rules for meter testing, &c., which have been called for by the increased pressures at which gas is supplied, have been discussed repeatedly for some years past; and the Committee thought the time opportune to bring forward definite proposals. A Sub-Committee was therefore formed, and evidence collected. The Sales of Gas Act (1859) was carefully examined, and various drafts prepared embodying amendments. About the same time it happened that the Association of Inspectors of Gas-Meters were working on the same lines. Co-operation was therefore invited, and several joint conferences arranged. It was then found that the new Gas Regulations Bill before Parliament contained clause 12, giving powers to the Board of Trade in extension of the Weights and Measures Act of 1904. The conference therefore decided to appoint a deputation to wait upon the Board of Trade, and submit the proposals to them under these new powers, rather than suggest the bringing in of a new Bill dealing solely with the Sale of Gas. The Board of Trade responded immediately, and received a deputation headed by Mr. James Ollis, of the Public Control Department, London County

Council. The deputation represented the Institution of Gas Engineers, Local Authorities, Statutory Inspectors, and the Society of British Gas Industries. The Board of Trade accepted the recommendations, on the understanding that unanimity had been secured among the different bodies represented. In a very short time, the New Statutory Rules and Orders, 1920, No. 2354, were published, and came into force on March 1 of this year. The principal provision is for the testing of meters at 2 in. initial pressure, with a differential of 5·10ths, in place of the ½-in. initial pressure prescribed by the Act of 1859.

[The Statutory Rules and Orders are reproduced in the report. They will be found in the "JOURNAL" for Jan. 5 last, p. 42.]

SECTION 5.—STANDARDIZATION OF METERS.

The Joint Committee have also drawn up the following new list for the standardization of dry meters and their revised denomination. The old-fashioned method of distinguishing size of meter by number of lights is dropped entirely. There are size numbers attached for convenience; but the meters will be rated in cubic feet per hour. The small dry meters have been speeded-up a little, in accordance with improved manufacture; but only the capacity per hour, the number of cycles or revolutions of the meter, and the size of unions, figure in the standardization. The dimensions of the meter-cases are not defined.

APPROVED NEW STANDARD SIZES OF DRY METERS.

[Coming into operation on Jan. 1, 1922.]

Number.	Capacity per Hour.	Capacity per Revolution.	Revolutions per Hour.	Bore of Connections.
	C.Ft.	C.Ft.		Inch.
1	30	0·125	240	¾
2	40	0·166	240	¾
3	60	0·25	240	¾
4	120	0·5	240	1
5	210	1·0	210	1¼
6	420	2·0	210	1¾
7	540	3·0	180	2
8	720	4·0	180	2½
9	900	6·0	150	3
10	1200	8·0	150	3
11	1800	15·0	120	4
12	3000	25·0	120	5

Nitric Acid by Gas Explosions.

There have appeared in "Engineering" some particulars taken from an illustrated description in "Stahl und Eisen" of the process for the fixation of nitrogen of Dr. F. Häusser, Director of the Kohlentechnik Gesellschaft, of Dortmund-Eving. Dr. Häusser renders the air explosive by adding some coal gas or producer gas to it; and it might be said he obtains his nitric acid from the exhaust of an internal combustion engine. Nitrogen and oxygen refuse to combine at ordinary temperature, but do combine at higher temperatures. The nitric oxide then formed decomposes again, however, unless rapidly cooled: and the technical difficulty of the oxidation is the removal of the nitric oxide from the hot atmosphere in which it is formed. The sudden heating to high temperatures which takes place during explosions seemed to offer favourable conditions. The results of small experiments were sufficiently encouraging for larger ones to be made in a factory adjoining a colliery from which coke-oven gas was supplied. Here the gas utilized is first freed from tar and ammonia, purified, stripped of benzole, and then sent through a meter into a compressor. The air is also compressed and passed through a heater-coil, so that it enters the bombs at 300° C., and a pressure of 6 atmospheres. As soon as the bomb is charged, the gas is exploded. The pressure rises to 22 to 25 atmospheres; and the exhaust valve is opened 0·15 sec. after ignition. The exhaust passes into a boiler, in which the gases are cooled down to 250° C. The gases then go through an aluminium coil to the water separators and the towers in which the nitric oxide is oxidized to nitric acid, and the nitric acid is absorbed by soda lye to yield nitrate and nitrite. It is remarked that "it seems wasteful to explode a quantity of gas merely to produce a little nitric acid, without utilizing the explosive energy at all. If the latter could be done, and the process be modified so as to raise the general economy of collieries and gas-works, matters would assume a very different aspect."

Vacuum Process of Coal Unloading.—The vacuum process has now been applied to the unloading of coal from barges at the City of London Electric Supply Company's Bankside depôt; and some particulars of the installation, with an illustration, are to be found in the August number of "Conquest." On the wharf there is a tower 65 ft. high, with platforms at different levels. On the top platform is a receiver from which flexible piping extends down into the hold of the boat to be unloaded. One section of the receiver is connected with a vacuum pump, which exhausts the air from it, thus sucking up the coal from the barge to the receiver. Only filtered air reaches the suction pumps. From the receiver the coal drops, through a double-compartment air-tight box, on to an endless belt, which conveys it to the storage bunker or to trucks. Coal up to 4 in. in size can be raised; and 60 tons per hour are dealt with by each of the two plants now at work.

COAL, COKE, AND BYE-PRODUCTS STATISTICS OF THE UNITED KINGDOM.

THERE is a good deal of statistical and technical information to be found in a recent publication of the Imperial Mineral Resources Bureau, the Chairman of the Governors of which is Sir R. A. S. Redmayne. It relates to the production, consumption, and value of coal, coke, and bye-products, and constitutes Part I. of the work on "Coal," which will form a portion of the annual volume or volumes on the mineral resources of the British Empire and foreign countries. This is the first year of publication; and an effort has been made to fill in as far as possible the hiatus (due to the war) in the publications relating to mining and metallurgical statistics—the period covered being from 1913 to 1919. Owing to the difficulty involved in procuring reliable information for these years, labour, health, and safety statistics have been omitted on the present occasion; but in future issues they will, it is said, be included.

Inasmuch as its use is increasing, a chapter is devoted to peat, in which it is stated that dry peat containing a minimum of ash (from 4 to 5 p.ct.) has a calorific value of about 5200 calories, or from one-quarter to one-third more than that of an equal quantity of wood. Several processes have been invented for the carbonization of peat with the production of a "semi-coke" containing a certain percentage of volatile matter, and the conservation of bye-products; and analyses are given of the products from the Ziegler coking plant at Beuerberg, in Bavaria. A number of methods, most of them based upon the Mond process, have been proposed for the manufacture of producer gas from peat; and their introduction has been more or less successful.

The different classes of coal are explained; and analyses, derived from various sources, are given in tabular form—including the composition of about a dozen gas coals. Coming to coke, we learn that a series of tests made some years ago by the American Radiator Company to determine the efficiency of domestic fuels showed "that gas coke of nut size had an efficiency of 78·7 p.ct., Pittsburg oven coke 71·4 p.ct., anthracite coal 66·3 p.ct., and Pocahontas coal 66·1 p.ct." It was also shown that, in the case of kindling, Pocahontas coal stood first; but gas coke of nut size was a close second, Pittsburg coke third, and anthracite last. As proof of the fact that different coals contain widely varying quantities of nitrogen, the following figures are quoted: English coal, 1·14 to 2·37 p.ct. of nitrogen; Scottish, 1·65 to 2·55 p.ct.; North American, 1·2 to 2 p.ct.; Indian (Bengal), 2·12 to 2·48 p.ct.; and Japanese, 2·85 to 3·62 p.ct. In 1913, 58 p.ct. of the production of metallurgical coke in the United Kingdom was obtained from bye-product ovens, compared with 80 p.ct. at the present time; while in the United States the percentage increased from 27 in 1913 to 40 in 1917. Until 1910 Great Britain was the leading producer of sulphate of ammonia, the greater part of which was then being obtained from gas-works liquor; but the production from coke-oven works has, since 1915, exceeded that from the former source of supply. In the United States, the sale or use of surplus gas from bye-product coking-ovens for illuminating purposes and for domestic and industrial fuel has shown a considerable increase. The gas used for these purposes in 1913 amounted to 64,553,941 c.ft., while in 1917 it was 130,826,575 c.ft. Mention is also made of its use in a similar way in this country.

There is a table of results obtained with different coals by low-temperature carbonization. These results, as compared with high-temperature carbonization, are stated to be a lower volume of gas, and a higher yield of tar but of a lower specific gravity. The gas obtained by low-temperature carbonization is of lower calorific value than that obtained by high-temperature carbonization, when the illuminants have in both cases been removed. The effect of low temperature is, further, to give a low yield of benzene and its homologues, and of ammonia compounds. It is added that "the solution of the problem of the successful working of the low-temperature process of carbonizing coal on a commercial scale does not yet appear to have been arrived at. According to Sir George Beilby, the solution of the problem depends on an outlet being found for the low-temperature coke, and a satisfactory apparatus being devised. He is not without hope that ere long an apparatus will be produced "which will tempt the orthodox gas engineers to give low-temperature distillation a serious trial on its merits." A process of "double carbonization"—that is, high-temperature following on low-temperature carbonization—has been suggested, and has been tried, particularly in the United States. In this process, the residual matter from the low-temperature carbonization retort is briquetted, and the briquettes are subjected to high-temperature carbonization to secure a high yield of ammonia and benzene compounds.

Subsequent sections of the report deal with the work of the Fuel Research Board, fuel analysis, the coal industry during the war, the method of coal control, &c. The coal and bye-products statistics follow, in the form of some sixty pages of tables. It should be mentioned that the price of the report (which is published by H.M. Stationery Office) is 3s. 6d. net.

Mr. John W. Crosthwaite, who died at Harrogate last week, aged 65, had been for many years Chairman of the Crossgates Gas Company.

SOME CONDITIONS AFFECTING THE USEFULNESS OF OXIDE OF IRON.

A report prepared by Mr. W. A. Dunkley, under a co-operative agreement between the Engineering Experiment Station of the University of Illinois, the Illinois State Geological Survey, and the United States Bureau of Mines, has been published as a University of Illinois Bulletin [No. 119]; the subject of the investigation to which it refers being "Conditions Affecting the Usefulness of Iron Oxide for City Gas Purification." It is pointed out that the present overloaded condition of the gas-purifying equipment in many plants, brought about by economic conditions during the past few years, has increased the interest attaching to gas purification. Purifying conditions in some plants have become critical on account of the greatly increased gas production, and the generally higher sulphur content of the fuels used for gas making. The financial condition of many gas companies practically prohibits the installation of larger equipment. The only solution of the problem for the present, therefore, lies in the more efficient use of existing equipment. That there is much room for improvement in this department of gas manufacture was shown in an earlier Bulletin published by the Illinois State Geological Survey.* There the purifying conditions in the medium-sized gas plants of Illinois were discussed, and certain improvements in operating methods were suggested; but it was stated that more information was needed relative to the properties of various types of oxide of iron, which have been used during many years for purifying gas. The purpose of the present report is to summarize the existing information on this subject, and to discuss experiments recently made in the effort to explain some of the observed facts concerning purifying oxides.

The writer says that sufficient distinction has not been made in the past between the rapidity or activity of oxides in the absorption of hydrogen sulphide, and the primary and ultimate capacity of these materials. The average gas operator calls an oxide "active" when it absorbs a fair percentage of hydrogen sulphide. Indeed, the term "active" is often used to indicate merely the ability to absorb hydrogen sulphide, without reference to rapidity or capacity. The failure to distinguish between these characteristics is not surprising, since there are no well-defined standards of performance with which to compare the behaviour of a particular sample.

Possibly, in the past, under average operating conditions, no careful distinction was necessary. If a particular material was capable of absorbing a high percentage of hydrogen sulphide, the rapidity of the absorption was of secondary consideration. With overloaded conditions, however, the velocity of travel of the gas through the purifiers has increased greatly. In some cases more than 10 p.ct. of the total daily gas production is purified during the hour of maximum make; so that at such times gas may be passing through the oxide mass at from two to three times the average rate. Chemical reactions require a finite, though frequently very brief, time for their completion; and in gas purification the time element becomes very important, especially after a portion of the purifying material has become sulphided. A considerable period of contact may then be necessary for the complete removal of the hydrogen sulphide by the remaining active material.

The relation of activity, or rapidity of action, of an oxide to its commercial value has not been definitely determined. Formulæ for the design of gas-purifiers sometimes take this factor into account indirectly; but none of them includes an individual activity factor, because no such factors for oxides have been worked-out. It is a fact well recognized among gas manufacturers that gas of a given hydrogen sulphide content can be passed much more rapidly through some oxides than through others, with complete removal of the hydrogen sulphide. This fact becomes all the more important in the operation of the catch-box. The hydrogen sulphide content of gas entering the catch-box is usually not more than 10 to 20 grains per 100 c.ft. of gas; and where the preceding purifiers are so operated that only this small amount passes them, the active life of the catch-box oxide is usually quite long. The quality and condition of the oxide in the catch-box have a very important effect on its usefulness for this purpose. It is frequently observed that an oxide which will remove 90 p.ct. of the sulphide present in gas containing (say) 100 grains of hydrogen sulphide per 100 c.ft. of gas, will not completely purify gas containing only 10 grains of hydrogen sulphide per 100 c.ft.

According to the law of mass action, the rate of a chemical reaction is in proportion to the masses of the active constituents present. Therefore the rapidity of the reaction between an oxide and hydrogen sulphide decreases with decreasing concentration of hydrogen sulphide. However, experience shows that there are marked absolute differences in the rapidities of oxides which must be taken into consideration if their relative values are to be compared. It is believed that no serious attempt has been made hitherto to establish a standard of comparison in respect to this factor; and a tentative test for comparing the rapidities of oxides is described. The measure of activity adopted for the purposes of the report is the weight of pure dry hydrogen sulphide gas which is decomposed by a given weight of the material under test in one minute, per unit of actual ferric oxide present in the same weight of material—an excess of hydrogen sulphide being present throughout the test. This measure of activity was employed only for purposes of comparison in laboratory tests, chiefly on new materials. To what extent it would indicate the behaviour of oxides in practice has not yet been determined.

* See "JOURNAL," Vol. CLIV., pp. 27, 148, 204, 266, 381.

PREVIOUS WORK.

After describing the methods of testing employed in the investigation, Mr. Dunkley goes on to say that, since the inception of the use of iron oxide for purifying gas, numerous reports of work carried on in the investigation of various phases of the subject have appeared. By far the larger number of these contributions have had to do with methods of purifying materials in the plant, and the disposal of spent oxide. Comparatively little has been written, so far as a search of the literature reveals, concerning the factors which immediately affect the sulphiding and revivifying reactions, and the physical and chemical principles upon which the behaviour of oxide depends.

Fulwiler and Kunberger* carried on some experiments with purifying oxides which seemed to go a long way towards the explanation of the peculiarities of certain oxides. They tested a variety of oxides, both commercial and laboratory samples, and concluded that the efficiency of oxide is dependent upon the state in which it exists; that the most efficient state is that known as the reversible hydrogel; and that it seems impossible to prepare such material artificially without a protective colloid. Fulwiler and Kunberger give a somewhat lengthy discussion of colloids, which makes their conclusion more intelligible to the average reader than it would be otherwise. The terms which they employ are rather difficult to define in a few words. The exact physical nature of ferric oxide in the form of a hydrogel is not known; but we may assume it has "a spongy or honeycomb-like structure, and retains more or less water." A reversible hydrogel is one which can, under favourable conditions, go back into an apparent state of solution, while an irreversible hydrogel does not. A protective colloid is a substance like gelatine, glue, starch, &c., which, under certain conditions, can go into an apparent state of solution, and which, when present with other reversible colloids, keeps them in the reversible state. Fulwiler and Kunberger made many attempts to prepare ferric hydroxide in the form of a reversible hydrogel, but state that they were not very successful. The materials produced with protective colloid retained their activities to hydrogen sulphide somewhat better than materials prepared otherwise; but no commercial method of preparation was evolved. They recognized that the activity of iron oxide is a function of the surface exposed, and that in general oxides having the largest specific volume are most active. They were inclined to the opinion that the water of hydration had no direct effect on the activity of oxides, but assisted by keeping the material in the active state.

Geoffrey Weyman† holds to the idea that ferric oxide forms a complete series of hydrated oxides stable within a very narrow range of temperature and vapour pressure conditions. He attributes the activity of ferric oxide for hydrogen sulphide absorption to its molecular state, and regards the amount of water of hydration as of bearing only in that it affects the internal arrangement of the molecule. Weyman states that oxides attain their greatest activity when dried for several hours at about 600° C. His definition of activity is the percentage of hydrogen sulphide absorbed per 100 grains of ferric oxide (Fe_2O_3) present, divided by the theoretical amount (63·9 p.ct.) with which ferric oxide is capable of combining. It should be noted that this conception of activity is different from the idea of activity which has been developed in this Bulletin. Weyman also made a considerable study of the reactions taking place during the sulphiding and revivifying of oxides.

EFFECT OF WATER CONTENT ON THE BEHAVIOUR OF OXIDES.

From the reports just referred to, it seems evident that these investigators recognized that the water content of an oxide had at least an indirect bearing upon its reaction with hydrogen sulphide. Their absorption tests with various oxides seem to have been carried on for too long a time to distinguish between the different rates of fouling of various oxides, since all but the slowest oxides will foul practically completely in one hour. Weyman did observe differences in the water-carrying capacities of some oxides as affecting their behaviour with hydrogen sulphide, as will be noted later.

In practical purifier operation, the effect of excessive or insufficient moisture in oxides is frequently observed; but just what percentage of moisture is desirable in a given material, or how to preserve the proper percentage for best operation, is a difficult matter to decide. Even if the proper amount of water is present in the material when it is put into the purifier, the water deposited or taken away by the gas is likely soon to upset this favourable condition. Just what part the water present plays in the action of the oxide has long been discussed by gas operators, and differing views are held.

It has long been a question for debate among gas chemists and, indeed, among chemists generally just what form of union exists between iron oxide and water. It has been generally recognized that iron oxides retain a certain amount of water with great tenacity. A sample of hydrated iron oxide may be heated to a temperature several hundred degrees Centigrade above the boiling-

* Proceedings of the American Gas Institute, 1913.

† See "JOURNAL," Vol. CL., p. 256.

point of water; and after exposure to such temperature for several hours it will still yield moisture on ignition at a red heat. Some chemists are not satisfied that all the water is expelled from iron oxide unless the material is ignited to constant weight with a blast lamp. Since it is generally assumed that all surface moisture is expelled from materials upon exposure for a few hours to a temperature slightly above 100° C., it is natural to infer that water remaining after drying is combined water rather than surface water. Indeed, it is a well-known fact that some chemical compounds lose a portion of their combined water at temperatures even below 100° C. The idea has been held, therefore, by some that iron oxide may form a series of hydrates of definite composition, each stable under certain conditions of temperature and vapour pressure; and it has frequently been conjectured, by those who are interested in the use of oxides for gas purification, that, were it possible to prepare and keep oxides in the form of the higher hydrates, such forms of oxide would be more active agents for purifying gas than the lower hydrates or non-hydrates to which the compositions of most commercial oxides more or less approximately correspond. The idea of the existence in Nature of a series of hydrated oxides of iron has been fostered by the tabulation in various books on mineralogy of a series of hydrated iron oxides. Those usually listed, with the chemical compositions assigned, are as follows:

Name.	Formula.	P.Ct. Water.
Turgite	$2Fe_2O_3 . H_2O$	5·1
Goethite	$Fe_2O_3 . H_2O$	10·1
Hydrogoethite	$3Fe_2O_3 . 4H_2O$	13·0
Limonite	$2Fe_2O_3 . 3H_2O$	14·5
Xanthosiderite	$Fe_2O_3 . 2H_2O$	18·4
Limnite	$Fe_2O_3 . 3H_2O$	25·3

Of these, goethite alone has well-defined physical and chemical properties. The other names in the list have been given because of certain indefinite physical differences, associated with plausible, but not well-established, chemical formulæ.

In the effort to establish the existence of these compounds, a number of investigators have attempted to prepare them synthetically. Directions for accomplishing this are given in some of the older reference books on inorganic chemistry. The writer attempted the preparation of these hydrates, but found (just as previous investigators had discovered) that, while it was possible to obtain materials approximating the theoretical compositions and physical properties assigned to these hydrates, it was extremely difficult, if not impossible, to prepare materials which had the exact composition, and were found stable under normal conditions. Incidentally, these attempts at the preparation of various hydrates gave a variety of oxides of known composition to work with in the attempt to correlate water content of oxides with their activities as hydrogen sulphide absorbers.

After much experimenting had been done, and the literature of the subject quite thoroughly reviewed, there was found a reference to some work by Posnjak and Merwin, of the Geophysical Laboratory of Washington. From some very careful work carried on over a period of several months, these investigators concluded that no series of hydrates of ferric oxide exists among the natural minerals; that the existing hydrate is the monohydrate; and that no definitely crystallized synthetic hydrates of ferric oxide have been prepared up to the present time. They feel certain that only two distinct types of "amorphous" hydrated ferric oxide exist—one yellow, and the other reddish-brown. The yellow is apparently essentially ferric oxide monohydrate; while the reddish-brown substance may hold its water in either a dissolved or an absorbed condition, or both. Thus the synthetic and natural hydrated ferric oxides exhibit, chemically, great similarity.

While it does not seem that the gas engineer can look for any improvement in the activity of iron oxides by the preparation of higher hydrates of definite composition, this does not prove that the water held by oxides has no effect on activity. It has been observed frequently that an oxide which has been overheated during preparation or during revivification, and has been thereby deprived of most of its water content, has its activity greatly impaired; and it has been generally recognized that certain natural bog ores with a high water content are particularly active. The idea that the water is in some form of combination with the iron oxide is quite natural; for it has been observed that oxides which have been dehydrated at a high temperature rehydrate very slowly, if at all. If the water were merely surface moisture, such behaviour would hardly be expected. Since the water content of an oxide obviously plays a part, even though indirectly, in determining the activity of the oxide for decomposing hydrogen sulphide, it was decided to study this effect.

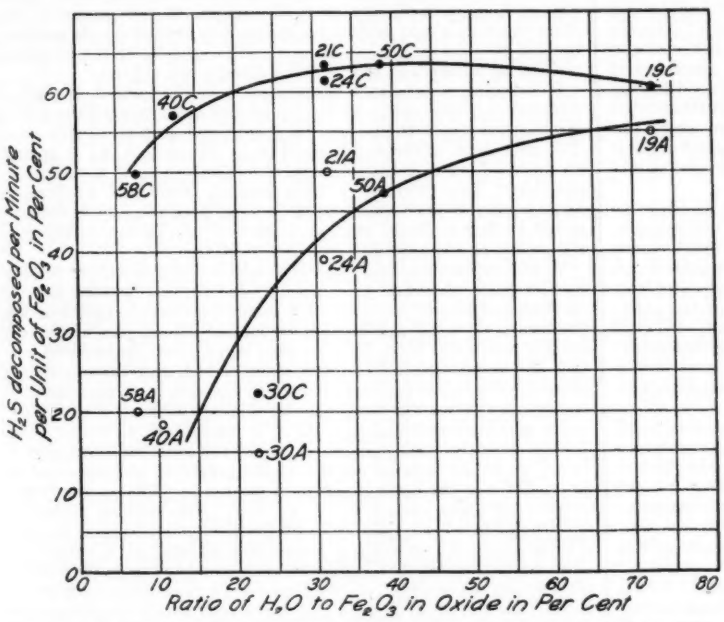


Fig. 1.—Activities and Capacities of Various Oxides after Drying to Constant Weight.

NOTE.—Points marked "A" denote activity in percentage of hydrogen sulphide decomposed per minute per unit of ferric oxide. Points marked "C" denote capacity of oxide for decomposing hydrogen sulphide during one fouling, in percentage of hydrogen sulphide per unit of ferric oxide, no oxygen being present in the gas.

An account is given of the determination of the water content, the preparation of samples for drying, and the drying. The dried samples were analyzed for moisture and iron content, and tested as to their activity and their primary capacity* for decomposing hydrogen sulphide. A table of the results obtained shows that different oxides have widely different water contents when dried under the same conditions. An attempt has been made in fig. 1 to plot the activity and capacity of the various materials in relation to their water content.

In order to use the same system of ordinates throughout, the capacities have been expressed in percentages of hydrogen sulphide decomposed per unit of ferric oxide. This might be termed "unit capacity." The relative capacities of various oxides would, of course, depend upon their iron oxide contents as well as their unit capacities. To obtain the capacity of an oxide for purposes of comparison it would be necessary to multiply the unit capacity by the percentage of ferric oxide present.

It will be observed that while in general there appears to be some relation between water content and activity, there are a number of points which fall far from the curve. As for capacity, the water content apparently has but little effect on this property, except that the rate of the reaction is so greatly retarded in some cases that for practical purposes the capacity is decreased.

(To be continued.)

* The primary capacity of an oxide for purifying gas may be defined as the ratio of the weight of hydrogen sulphide gas which a certain weight of the oxide decomposes until completely sulphided without any revivification, to the weight of hydrogen sulphide which theoretically would be decomposed by the same weight of actual ferric oxide (Fe_2O_3).

Cement and Lead-Wool Pipe-Joints.

Mr. Henry Fink, the Superintendent of Distribution for the Detroit City Gas Company, says that during the last four years his Company have laid approximately 32,000 ft. of 16-in., 7500 ft. of 20-in., and 35,000 ft. of 24-in. high-pressure mains, using combination cement and lead-wool joints. The method adopted is that of caulking three lengths on the bank. Just before each pipe is laid in the trench, it is carefully swabbed-out, to clear it of all dust, dirt, &c. The three-length sections are lowered by two derricks. While the work of grading and digging bell-holes is going on, the pipe lined-up is yarned and cemented preparatory to making the combination joint. All lead joints are caulked with air-hammers, and special sets of caulking tools to fit the hammers. These hammers are of the Keller type, using 23 c.ft. of air per minute, furnished by a portable gasolene engine driven air-compressor. This compressor is capable not only of looking after the caulking machine, but of handling the hammers used for tamping later on in the work. The caulker drives up the yarn placed in the joint by the mainlayer, and puts in additional yarn until an even space in depth remains for the cement and lead wool. As much care must be used in driving up the yarn as in caulking the lead. The foundation of a lead wool joint is exactly the same as of a cement joint. When the joint is yarned and cemented, and the cement driven into place, the remaining space must be cleaned free from cement, especially the lead groove inside the bell. This must be allowed to stand for at least 24 hours before any attempt is made to put in the lead. The cement and yarn, now set, make a firm and solid foundation for the lead wool, which must always be kept dry. Any that shows a dull colour has been exposed to dampness, and is unfit for making good joints.

MANAGEMENT AND REPAIR OF FURNACES IN SMALL GAS-WORKS.

By M. Changarnier.

[A Communication to the Tours Congress of the Société Technique du Gaz.]

(*Concluded from p.* 328.)

Stoppages in Ascension Pipes.

Obstruction of ascension pipes by carbonized tar requires constant attention in a small works. The pressure of gas at the joint of a retort-head is a sign of such obstruction, indicating the necessity of removing the plug from the top of the rising pipe and cleaning out the latter. At times, the stoppage is of such a thickness that the tool employed for the purpose will not pass, in which case the latter must be heated to a dull red and forced down. The pitch is thereby melted, leaving a sufficient passage for the gas made during the working-off of the remainder of the charge in the retort. The door of the retort is then opened, and also the plug at the top of the pipe. The pitch may then be burnt-off in the current of air, and the pipe cleared further with a tool. Unfortunately, this cannot always be done, since the pitch becomes almost as hard as iron, and forms a deposit of such thickness as to reduce the diameter of the pipe by several centimetres (say, an inch).

Various means have been suggested for avoiding these obstructions: (1) The furnace may be regulated for less heat in the upper part; (2) a little coal may be placed on the iron retort-head, where it does not become completely carbonized; (3) the outside of the pipe may be cooled with water, sprinkled on to an encircling iron coil; (4) a syphon water-dripper may be arranged in the pipe; (5) a deflector may be placed in the retort-head, to act as a collector of tar. The trouble of inserting and removing this appliance is one reason why its beneficial effect is not more widely utilized; (6) the use of pipes of wrought instead of cast iron, and therefore more easily cooled by air or water.

All these means are more or less efficacious; but the chief preventive is often overlooked—viz., the keeping of the ascension pipes in a thoroughly clean condition. The obstruction is allowed to accumulate until it becomes serious, and requires drastic remedy. The pipes should be cleaned of deposits by systematically attending to them, at least once a week—that is to say, one pipe each day in the case of a seven-retort bench; and as the pipes are fairly clean, the work is soon done.

For this preventive cleaning the best tool consists of two slightly curved and sharp blades of unequal length, fixed to the end of a rod, with the blades kept at the required distance apart by means of a suitably shaped metal piece. The tool has a diameter only slightly less than that of the pipe; and by turning it in the latter, the coating of pitch is detached. It is well to have two tools of this pattern, one about two-thirds the length of the pipe and provided with a handle of such size that, if the workman happens to let go, the tool cannot fall down the pipe.

For clearing the bottom of the pipe, a second tool is provided. It is jointed, and therefore can be used for the pipes of furnaces having little roof clearance. The lower part can be introduced into the pipe while the handle portion is held at right angles, and the whole then thrust straight down.

In addition to regular clearing, attention should be given to keeping the bases of the ascension pipes clear by inserting a tool into them from the retort-head. If the passage is so blocked with pitch that the tool cannot be inserted, a way is first made with the blade; and the implement is then employed.

Clearing Tar-Mains.

Pipes delivering tar to the hydraulic main require clearing about once a month by tools of gimlet or corkscrew pattern, or else of spoon section. When choked with tar, the latter can be quickly burnt off from these tools by putting them into the furnace for a few seconds.

Frequently there is produced in the hydraulic main a mass of tar almost up to the level of the dip-pipe. A special type of tool for dislodging such deposit is provided, and is introduced into the hydraulic and forced down by the handle. Side pieces are then pressed out nearly horizontally, when by turning the handle in this position the mass of tar is dislodged.

Producer Furnaces.

M. Changarnier, after briefly reciting the principles and advantages of the producer type of furnace, gives the following practical directions for its starting, management, stoppage, and adjustment, particularly in reference to the "Frère et Hovine" Producer of M. Breuillé, of Paris—a furnace used by him for a number of years, and possessing the advantage of utilizing coke-dust and coal-slack as fuel. The instructions are, however, mainly applicable to any small producer furnace.

In starting the furnace, the main chimney damper is opened about 25 cm. (10 in.), and each of the dampers behind the valves on the recuperator front by about 5 cm. (2 in.). The dampers for the secondary air in the lower part of the recuperator are kept fully closed. The valve for the admission of primary air to the producer is opened full, and about 3 cm. (1¼ in.) of water is delivered into the base of the producer. A fire of dry wood is lighted at the back of the grate, and after two hours some small coke is charged in sufficient quantity to cover only the back half of the grate, so as to permit cold air to enter in front of the fire, and thus avoid deformation of the fabric by too rapid heating.

After twenty-four hours, the fire is increased to the extent of two-thirds of the grate; and on the fifth day, the whole grate is covered with fuel. On the seventh day, the grate is charged with a layer of coke of 25 to 30 cm. (10 to 12 in.), and the dampers are opened 5 to 7 cm. (2 to 2¾ in.) so as to give a red heat in the producer. Clinker is removed from time to time; and when, after twelve to sixteen hours' combustion, the producer is at a good heat throughout, the fire is fully charged with coke to a depth of 30 to 35 cm. (12 to 15 in.). As soon as the gas-outlet ports are bright red, the production of gas is begun.

With a maximum of 35 cm. (15 in.) of fuel on the grate, and with this fuel in good combustion, the secondary air is admitted in small quantity by opening the valves supplying cold air under the recuperators about 1 cm. The gas lights in the furnace; and in this way the production of gas is started without risk. After half-an-hour, 5 hectolitres of coke are put in the producer, and allowed to draw-up; and the valves for the secondary air are then opened to 3 cm. (1¼ in.). After a further half-hour the producer is filled with coke and the valves opened 4 cm. (1½ in.).

In running a producer furnace on coke dust and coal slack, a mixed fuel is first made of 60 p.ct. of fine coke (passed through a sieve not coarser than 6 mm. to 1 cm.) and 40 p.ct. of fine coal. The coke dust, to the depth of 10 to 15 cm. (4 to 6 in.) is spread on a level floor and the fine coal shovelled on to it as evenly as possible. The mixture is then roughly shovelled to form a conical mound and, as required for the producer, is thoroughly mixed, so that no black streaks of the coal can be seen in the grey substance of the coke dust.

With the producer at a good heat, which requires a layer of coke on the grate of about 70 cm. deep (27 in.), the furnace door is opened, and about 40 kilos. of the mixed fuel are charged into the producer. It must not be thrown in, but placed just within the furnace, so that it spreads as an even layer down the inclined surface of the producer. The furnace is closed, and three-quarters of an hour allowed to elapse before re-opening it, so that the preceding charge has time to carbonize and agglomerate the mixture. After this interval, with the aid of a round tool of about 3 cm. (1¼ in.) diameter and 3·5 m. long (12 ft.) the crust on the charge is raised on to the inclined surface of the producer and removed on to the grate in the form of pieces of from 2 to 3 kilos.; the pieces closing any holes formed during heating. The inclined surface is left free of fuel for a quarter of an hour, in order to heat up, and a fresh charge of 40 kilos. is then made as before. Charges are successively distributed in this manner so as to bring the level of the heating up to about 70 to 80 cm. (28 to 32 in.) above the grate. Each time the preceding charge is put over on to the grate, care must be taken to see that it is well agglomerated. Otherwise charging must be done at longer intervals or, better, with a smaller quantity. If this precaution is neglected, the temperature of the producer falls and becomes too low to agglomerate the charges; and the grate becomes choked with dust. If this should happen, charging should be stopped, and the grate raked, so that with a thinner layer of fuel the heat recovers in the producer, and allows the charges again to be agglomerated.

Usually with a good chimney draught, the openings of the various dampers should be roughly as follows: Draught, 6 to 7 cm. (2½ to 2¾ in.); secondary air, 1·5 to 2 cm. (1⅜ to 1¾ in.); primary air, full open. As long as the recuperators are dull-red, the secondary air should be admitted in small quantity, so as to allow them to heat up. The furnace should then be under slight pressure before the removal of the clinker. After charging, there are always a few minutes during which there is pressure in the furnace, arising from distillation of the coal. The hot gases on the sides of the furnace should be neutral—neither oxidizing nor reducing. This is shown by putting in a length of thin dry wood through one of the side plugs. The wood should distil-off for a few seconds and then be seen to burn feebly. Gases escaping from apertures on the front should not show a blue flame when burning.

The following are the conditions for the proper working of any producer furnace. The charging of the producer should be done at fixed times, and to the extent of about 35 to 40 kilos. each hour. Before turning the agglomerated fuel on to the grate, it should be seen that the watering is ample, and the grate should be cleared of cinders. The removal of clinker is done at the end of each twelve hours by means of a flat tool and a hook; the small quantity of coke taken out at the same time being sorted and returned to the producer. As a rule, the furnaces which are of such size as not to require urging, should not be overworked; it is not necessary that a bright reflection of the fire should be visible in the water of the ash-pan.

An important point is to avoid forming hard clinker, due to insufficient water in the base of the furnace, since this reduces the quantity of fuel which can be sorted from the clinker. The working of the fire is quickened by opening the draught dampers from ½ to 1 cm. (¼ to ⅜ in.) and slightly increasing the openings for the primary and secondary air. But it should be within strictly narrow limits.

When running a furnace on a cheap fuel mixture (fine coal and coke), better qualities of fuel must be avoided—*e.g.*, coke, small coal, &c., on occasions when the furnace is seen to be at a low heat. If mixed with the fine coal, agglomeration of the charge is interfered with, and the producer is obstructed. It is better, in such circumstances, to alter the proportions of the mixture, and reduce the coke somewhat, but not below 50 p.ct. As soon as

the producer has recovered its heat, the normal proportion is again used.

It should be understood that the producer should be at a heat to agglomerate the charge on the inclined surface, and therefore one can do with a little pre-combustion of gas in the producer, requiring a somewhat thinner layer of fuel than in ordinary coke producers. The stoker needs to acquire skill in having enough heat in his producer without keeping the fire too low. This mode of working has the advantage of permitting more frequent charging, which as a rule should be done at intervals of an hour. The management of the furnace is not laborious work (there is no heavy work of removing clinker), but it requires to be done carefully and systematically in order to obtain full economy of fuel.

ADJUSTMENT OF DRAUGHT DAMPERS.

The damper plates are first pushed down in their guides, and then with a length of iron of about 75 cm. (30 in.) divided on the upper flat part into centimetres, &c., and placed so that the hooked end bears against the front of the plate, the latter is pulled up the distance required in the damper opening—allowing 2 centimetres for the overlap of the guide on the plate. The recuperator is in good working when the first section at the top is bright-red, and that at the bottom black—a condition which one should invariably endeavour to secure in adjusting the furnace. If the recuperator cools in the upper part, the supply of secondary air should be immediately reduced.

WHEN PUTTING THE FURNACE OUT OF ACTION.

When stopping a producer furnace, a charge should just have been made. The inspection apertures in the front and all doors are completely closed so as to exclude air; also the secondary air valve at the foot of the recuperator is closed and luted, and the producer door and the valves fitted to it completely shut. All parts where air could enter are well luted; so that the internal temperature of the structure keeps up for about a week, falling very slightly by radiation. The retorts and the whole of the furnace then cool very gently, and not even the retorts will develop cracks. On the other hand, the coal in the retort distils as the furnace cools, and does so in a manner so thorough that a very hard coke is obtained, which is readily withdrawn as soon as the furnace has died-down.

CONVERTING A PRODUCER FROM FINE FUEL TO COKE.

When the charge on the inclined surface has been completely carbonized and agglomerated, it is turned over on to the grate, closing all the openings in the fuel on this latter. The producer is then charged with 5 hectolitres of coke, and a quarter of an hour is allowed to elapse for this to draw-up. The secondary air at each valve is then increased by ½ cm., and a further 5 hectolitres of coke are added. When this has drawn-up (in half-an-hour) the secondary air valves are further opened by the same amount, and the producer is then fully charged with coke; the secondary air being then supplied in quantity for the adjustment of the furnace—that is to say, the combustion of the gas from the producer.

The grate for fine fuel being much larger than is required for coke, it is well, after this adjustment, to close the damper on the main chimney flue, or else the dampers of the recuperator, in order to avoid too great a rise of temperature.

TESTING THE PRODUCER GAS.

As already mentioned, the furnace gas should be neither oxidizing nor reducing. On placing a light lath of dry wood through one of the sight holes, it should carbonize for a few seconds and then burn feebly. In making this test of the gases, several different results may be obtained. If the lath does not take fire in the furnace, it is a sign that there is too much gas. The secondary air should then be increased, particularly if the recuperator is hot. It can take more air without becoming cooled. Sometimes the lath does not take fire in the furnace, but the flame escapes by the aperture through which it was inserted. In this case, there is still too much gas—the furnace being in a state of too much pressure. So the secondary air should be increased, and also the draught somewhat. A further behaviour of the lath is that it does not take fire in the base of the furnace, but at the inlet; and the flame dips down. In this case, there is still an excess of gas, but to a less degree than in the two preceding cases. The recuperators require more air; and if any back-pressure is produced, the dampers must be further opened.

It will sometimes be noticed that the flame is stagnant in the furnace (the latter heating badly) although both the producer and recuperators are hot. This is a sign of insufficient draught. The valves on the front of the recuperator or the main damper should then be opened, so as to give 2 to 3 mm. exhaust above the valves. This is the normal draught for good working. With coke, the producer does not require to be very hot. It should be full to the charging hole and barely at a red heat.

Although there are at the present time different systems of producer-furnaces, the principle of all of them is the same, and the foregoing instructions can be applied to them. At the same time the maker's own full directions for the working of his furnace should be obtained.

A SUGGESTED WORK SCHEDULE.

M. Changarnier concludes his highly detailed consideration of practice in small gas-works by suggesting the following schedule or time-table to which a foreman should endeavour to adhere.

The things to be done every day include: Temperature of the furnace noted; manometer pressure recorded on chart; gas tested with lead acetate paper; density taken of ammoniacal liquors; one, two, or three ascension pipes, according to the number of benches in working, burnt off and cleaned; tar drawn-off from hydraulic main, and replaced by water.

Included in the regular weekly programme are: Monday, examination of coal stocks for signs of heating; Wednesday, pumping the various works' syphons; Thursday, cleaning motors and grinding valves; Friday, testing all valves (including those seldom used), for proper working.

Reminders for items to receive attention once each month relate to the cleaning and greasing of the charging machine on the 1st and 15th; inspection of the travelling gear of the charging machine on (say) the 5th; clearing furnace flues on the 10th; starting removal of carbon from retorts, on the 20th; application of grouting to the front of the furnaces in use and filling cracks in the fabric, on the 25th; cleaning of the furnace benches and hydraulic mains, on the 30th. The clearing of the main flue to the chimney stack and the base of the latter may receive dates for attention twice in the year.

THE PRESENT POSITION OF SMOKELESS FUELS.

By F. S. SINNATT, M.B.E., M.Sc. (Tech.), F.I.C., M.I.Min.E.
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[From the "Journal of the Royal Sanitary Institute."]

The commercial literature on the subject of smokeless fuels is considerable; and it appears desirable to collect the material in order to attempt to ascertain the general lines along which the industry concerned with the manufacture of artificial fuels by the carbonization of coal is proceeding.

It is not proposed to discuss the relative advantages of gas, electricity, and smokeless fuels, but to assume that there are many people who wish to have a fire of solid fuel in certain rooms in their houses. This desire may be largely sentimental; but many hold that solid fires are more healthy. Everyone wishes to reduce the black smoke and fog nuisance, especially in large towns; and the householder is offered four main alternatives—gas-fires, electric heating, central heating, or smokeless fuel.

It is generally recognized that coke, as obtained from gas-works, is not entirely suitable for combustion in ordinary grates, owing to the difficulty with which it ignites. But if a sufficient supply of good coke were available, the need for smokeless fuels would not be so pronounced. In modern gas-works there is a tendency to produce increasingly large volumes of gas; and if it is assumed that the coal tar and ammonia are still important by-products, the increased volume can only be produced at the expense of the coke, with the result that the percentage of inorganic constituents in it becomes excessively high, and cases can be cited of coke containing as high as 20 to 30 p.ct. of ash and a considerable percentage of water. Such fuel as this is not suitable for domestic fires; and to offer the material for household purposes is an injustice to the small consumer (who is at the mercy of the gas-works), and an injury to the movement for the wider use of this fuel. This tendency in modern gas-works reaches its culminating point in the comparatively modern process of converting the whole of the coal into gas, without producing any coke. The consequence is that many households which formerly used coke have now to burn coal if they wish to have solid fuel. It therefore appears that, although the larger production of gas is a step forward and leads to a decrease in the smoke-nuisance, there is on the reverse side a greater use of coal to replace the coke which was obtained from gas-works. The shortage of suitable coke makes it desirable for the industry producing smokeless fuels to be developed in order that a supply should be available.

Many of the processes for the manufacture of smokeless fuel are in an experimental state; but certain of them have made sufficient progress to indicate that they may become large industrial processes.

REQUIREMENTS OF SMOKELESS FUEL.

The manufacture of smokeless fuel is, in itself, a sufficient incentive for the carbonization of coal at a low temperature; but the principle involved has certain additional advantages which must receive notice. Thus, the weight of the products per ton compared with those obtained in ordinary gas-works, is as follows:

	High Temperature Gas-Works.	High Temperature Coke-Oven.	Low Temperature.
Gas	12,000 c.ft. (550 B.Th.U.)	11,500 c.ft. (450 B.Th.U.)	6000 c.ft. (750 B.Th.U.)
Tar	10 gallons	8 gallons	20 gallons
Coke	13¾ cwt.	14·4 cwt.	14·5 cwt.
Ammonium sulphate	25 lbs.	28 lbs.	15 lbs.

The amount of tar obtained is much greater than that secured at a high temperature, while the amount of ammonia and the volume of gas are considerably less. The efficient separation and utilization of the tars from the low-temperature carbonization of coal have not been completely solved, and considerable research work is still required. The products from the tar are compounds, belonging to the aliphatic or associated series, as distinct from those present in the tar from the high-temperature carbonization, which contain compounds of the benzene series.

Both these series of compounds have special commercial applications; but whereas the benzene (high-temperature carbonization) is of vast importance to the coal-tar colour, disinfectant, motor fuel, and explosives industries, the compounds obtained from the low-temperature carbonization are chiefly of importance in two industries only—for motor fuels and for lubricants. It is obvious that the products are not so valuable as those obtained from ordinary coal-tar.

The volume of gas produced is considerably smaller than in high-temperature carbonization; but it would appear that this gas may find other application than burning for ordinary purposes.

The reasons for the necessity for smokeless fuels are economy in the burning of coal, shortage of coke (and that available is of inferior quality), reduction in the number of fogs, economy due to clean buildings, and reduction in the amount of washing and cleaning in the household.

Smokeless fuel should possess some of the following characteristics: It must be smokeless and ignite with ease; should not be too fragile, so that it can be handled with safety, and should not be too bulky; should not absorb water, and, if it becomes wet, it should dry in a reasonable time. It should have a low ash-content, which should not be powdery; must contain only a small percentage of sulphur; must be of a porous nature, so that its combustion will not take place only from the outside, but enter into the texture of the material, in order that the ash which is formed does not cover the surface of the fuel and prevent combustion.

The following is a list of smokeless fuels with which the author is acquainted: Low-Temperature Carbonization Fuel; Tarless Fuel; Carbocoal; Coke Briquettes; Lignite Utilization Board Fuel; and Exors. J. Hargreaves Coke. Others have been mentioned in the literature, but no specimens have been examined by the author.

Low-Temperature Carbonization Fuel.

The coal used is washed bituminous slack, and is conveyed into hoppers which contain the exact charge required for a retort. The charge remains in the hopper until the previous charge in the retort is carbonized; and during this period it absorbs an appreciable amount of heat from the tops of the retort. Between the hopper and the retort is a rotary door, which, when open, allows the coal to fall gently into it. At the bottom of the retort is a similar rotary door for discharging the product. Below this door is a gas-tight chamber, into which the material is admitted when the carbonization is complete; and it remains there until the succeeding charge is ready to leave the retort. When the coke door is opened, the original charge, which has now become quite cool, passes from the chamber. The low-temperature coke is kept within the air-tight chamber in order to prevent loss of volatile constituents and deterioration due to burning in the air; and it was found objectionable to cool it by means of steam, as this changed the colour from black to grey. The retorts are built of refractory material; but experiments are in progress on the use of cast iron, in order to ascertain whether this can be applied. The figures in the table are quoted from a paper by Dr. Davidson, given before the Institution of Engineers, at Bradford, Dec. 13, 1920.

Tarless Fuel.

This process indicates a novel treatment. The coal was carbonized in specially designed (Tozer patent) vertical retorts of cast iron, arranged so that the coal was carbonized in layers not thicker than about 5 inches. The carbonization was carried out at about 550° to 600° C. under a pressure of about 3 inches of mercury (vacuum 25 inches of mercury). The products of carbonization were drawn from the coal, leaving a residue which was a perfect smokeless fuel.

Carbocoal.

The manufacture of carbocoal introduces a new principle. The pulverized coal is fed into horizontal retorts, 20 ft. long, and 7 ft. diameter, lined with carborundum, and fitted with two overlapping series of arms attached to two revolving shafts. The coal is stirred throughout the low-temperature carbonization, and is gradually forced to the outlet of the retort, where it is automatically discharged. This process is a continuous one, and is conducted at a temperature of about 500° C. The coke obtained by the above treatment is in a state of very fine powder, and from the ordinary point of view is valueless. It is, therefore, mixed with pitch as a binding material obtained from the oils distilled in the plant, and made into briquettes, generally egg-shaped. The briquettes are fed into an inclined retort, heated to a temperature of 1000° C. The coke and pitch now undergo a second carbonization at the temperature generally prevailing in ordinary coal-gas works. The result is that the coal is deprived of practically all its volatile products; and the pitch is also decomposed, while the fuel which leaves the plant is a coke briquette. The fuel has certain distinct features. It is compact, tenacious, non-fragile, but, from experiments carried out by the author, somewhat difficult to ignite.

Lignite Utilization Board Briquettes.

This process has been designed specially to deal with the lignite which has been found in large quantities in Canada. It consists in carbonizing the material in a finely pulverized state, in a retort so inclined that the material is fairly free in moving through it. The lignite is non-caking. The carbonization is carried out at a low temperature, and the resulting coke is mixed with a binding material and briquetted at a temperature of about 300° C. The resulting fuel is a perfect type of briquette, which is practically smokeless. The process is of some interest in view of the large amount of lignite which is available throughout the British Empire, and which has not received the attention it merits—largely owing to the fact that its calorific value seems too low to be an economical product to work. It would appear that by carbonizing and subsequent briquetting, it is possible to convert it into a fuel having a distinctly high relative calorific value—see analyses.

Carbon Smokeless Fuel Briquettes (Sun Fuel Company).

One part of bituminous coal is mixed with three parts of anthracite coal (by weight), and water is added to the finely powdered mixture up to about 12 to 15 p.ct. The stiff paste thus formed is pressed into two sets of moulds, which, when placed to face, are automatically locked together, and passed through a carbonizing chamber at 700 to 900° C. for fifteen minutes. The volatile matter evolved amounts to about 14 to 17 p.ct., and the resulting briquette is a coked mass, in which the carbonization of the bituminous coal has led to the agglutination and binding of the anthracite. The proportions of bituminous and anthracite coal may be varied according to the quality of the former.

Exors. of J. Hargreaves of Low-Temperature Coke.

Experiments have been carried out upon the low temperature carbonization of coal in a modified coke-oven, with a view to determining whether a suitable product could be obtained. These have proved successful; and a compact fuel has been produced containing up to 12 p.ct. of volatile matter, and burning freely. The coal used was Mountain Mine coal, which has a very high caking power. The product is a very excellent smokeless fuel.

Testing Smokeless Fuels.

No convenient method of determining the relative values of different smokeless fuels has been developed. Trials on a standard grate are laborious and impossible for the ordinary consumer. It was, therefore, considered to be of interest to place on record the values for two requirements, which are of some importance—the proportion of volatile matter present and the texture or microstructure of the coke. These two features are important, as they indicate the approximate properties and the ease with which the fuel will ignite and continue to burn. Fuels low in volatile matter will be difficult to ignite, and they burn sluggishly. If the texture is very porous, the material will be fragile and burn rapidly; while if too compact, the reverse will be the case.

The following table shows the approximate analyses of specimens which the author has received. It should be recognized that the percentage of ash depends largely on the kind of coal used.

Smokeless Fuels.—Chemical Analyses.

Percentage.	Lignite Low Temperature.	Carbocoal.	Briquette Sun Fuel Co.	Hargreaves Coke.	Special Briquette	Low Temperature Carbon Coke.
Water	6·44	2·03	3·10	0·60	2·60	2·42
Ash	16·85	15·66	10·48	10·70	9·00	4·70
Volatile matter	22 43	5 94	10·08	7 80	13·00	15 45
Volatile organic matter	15·99	3·91	6·98	7·20	10·40	13·03
Coke	77 57	94·06	89·92	92·20	87·00	84·55
Fixed carbon	60·72	78·40	79·44	81·5	78·00	79·85
Calorific value B.Th.U. per lb.	10,280	11,570	12,740	13,180	12,400	13,550

Conclusion.

From the above it will be gathered that the industry is, at present, in its infancy relatively to the coal gas, coke, or coal industry; and that in this country, with the exception of the low-temperature carbonization process, it may be said to be in an experimental state. It appears desirable that collieries or gas-works, or both, should undertake the manufacture of some type of smokeless fuel. Such an undertaking would solve the problems of fuel-conservation, air-pollution, and efficient heating for our houses. Under such an ideal state of affairs the coal could be worked at the pithead, or in conjunction with coal gas.

A Small-Size Gas-Producer.—The Liliput gas-producer of the Gasmotoren-Fabrik Deutz is, states "Engineering," cast in one piece with the base of the purifier, and supports the upper cylindrical portion which is charged with coke. The advantage of the one casting is that the pipes and pipe connections are replaced by ducts and ports, and that the weight is kept low. The ring plates of the step-grate can be turned on the balls on which they rest. Water drops down upon the rings. There are no pre-heaters and no warm-water tanks. The Liliput suction-gas apparatus is built for producing from 10 to 85 cub.m. of gas per hour—sufficient to yield from 4 to 35 H.P. In tests made at the Zentrale für Koksverwertung, in Berlin, the consumption of German anthracite, in lumps less than 1 in. diameter, was 0·562 kg. per horse-power-hour, when the 6-H.P. motor was developing 7·24 H.P. for seven hours. Even when not utilized to its full capacity, power from such suction-gas installations, it is claimed, might well compete with power from electric mains.

A HOME-MADE BURNER FOR A BOILER.

In connection with a large heating plant attached to a United States western college, one of the oil burners went out of commission at a time when the weather turned cold and the maximum amount of heat was needed. This necessitated the improvising of some sort of a fire—and on short notice, as only two out of the three boilers could be operated. The engineer therefore devised the gas-burner described as follows in the "American Gas Journal." He set the entire boiler-room force at work upon it, and had it operating in 36 hours. It has proved so satisfactory that it has been kept in almost constant use for three months. It burns gas at 6 lbs. pressure, and gives a fire of tremendous heat capacity, with little noise and great economy. Ordinarily only two of the four burners are kept in operation, so great is the heat generated. With all four burners going at full capacity, the device will generate sufficient heat to keep a 300 H.P. boiler at full load.

The four burners operate from a header connected directly to the 2-in. gas-main. This header was made from a piece of 5-in. iron gas-pipe cut 6 ft. long. One end was capped, and the opposite end fitted with a 5 in. by 2 in. reducing coupling. A short nipple and a valve were used to connect this end to the gas-line. First the width of the fire-doors were obtained, and then the distance between them. These measurements were used to determine the points at which the burners were to be tapped into the header. The measurements would, of course, vary with various makes of boilers. Next a chalk mark was struck along the side of the header, parallel to its sides, and punch-marked where the holes were to be drilled for the burners. These were then drilled and tapped for ¾-in. pipe. Into these holes were threaded four ¾-in. nipples 3 in. long, and a ¾-in. gas-cock threaded on to each nipple. When this was completed, the header was set in position in front of the fire-doors by iron brackets arranged to hold it solidly. The gas-cocks pointed exactly horizontally into the fire-doors.

The burners were made of 6-in. steel irrigation pipe, found lying about the grounds. The tar covering was removed, and four good sections, 30 in. long, were cut out of it. One end of each piece was cut down for a distance of 6 in. into four slots. This was done by marking off the circumference of the pipe into eight equidistant points, and sawing down at right angles with a hack saw. Then the four openings were made by cutting out the bottoms between the ends of the cuts with a cold chisel and hammer. Next, four sheet-steel discs were made 7 in. in diameter with a ⅞-in. hole in the centre. One disc was fastened over the ends of the slots in each burner, by riveting on with four angle-irons. Lastly, a sheet-steel sleeve was riveted together 6 in. wide and slightly larger in diameter than the burner, so that it would slide down over it, and bear against the disc, thus closing the four slots. By sliding the sleeve back, however, the openings could be made of any size desired.

The nozzles consisted of four pieces of ¾-in. pipe. One end was threaded for 2 in., and the opposite or nozzle end was heated in a plumber's torch and hammered flat, so that the resulting slot measured ⅛ in. wide. A lock-nut was threaded on to each nozzle as far as it would go, and the nozzle slipped inside the burner, slot towards the round end. Then the threaded end of the nozzle was brought back through the hole in the disc until it brought-up against the lock-nut. A second lock-nut was then threaded on, and tightened-up against the outside of the disc, thus holding the nozzle securely in position. This completed the assembling of the burners.

Firebrick was laid in the fire-doors at such a height that it would support the burners horizontally after they were in position. This was done, of course, by threading the projecting ends of the nozzles into the gas-cocks, being careful to leave the flattened end of the nozzles all in the same position—preferably horizontal. When everything was in its proper relation, the rest of the firebrick was mortared in place so that the entire door was closed tight. A piece of 1-in. pipe was inserted in the mortar between each pair of burners. A cap loosely threaded on served to cover the opening when not in use.

The burners are lighted by inserting a piece of burning paper in the air-slots, and then turning on the gas at the cock. The gas pressure and the opening of the air-slots and the gas-cocks determine the intensity of the flame.

Oxy-Acetylene Welding of Steel Plates.—In some hints to oxy-acetylene welders, Mr. Fred E. Rogers says that one secret of success when welding steel plates having a thickness up to ⅜ in. or more is to form a large puddle. The practice of one large concern is to break-down the side walls in advance of the puddle for a distance of 1¼ to 1½ in., making sure that the metal is fused at the bottom of the V. It is not their custom to carry the penetration to such an extent that the metal drips through the joint and hangs in drops beneath. This condition is objected to; and the effort is made to carry the weld through flush, and no more. Then active puddling with the welding-rod begins; the pool of molten metal being about ⅜ in. wide and ¾ in. long. The torch is whipped off the puddle from time to time. This causes the metal to "freeze" on the surface in semi-circular ridges.

THE MACLAURIN CARBONIZATION PROCESS.

The Maclaurin system of low-temperature carbonization, which is characterized by the use of an internally heated retort, as opposed to the usual externally heated type, some time ago received considerable publicity; but of late little has been heard of it. Work is, however, still being actively carried on in connection with the process, as is evident from an article (with illustrations of a plant at Grangemouth) that appeared in a recent number of the "Iron and Coal Trades Review," from which the following extracts have been taken.

The initial plant at Port Dundas Power Station [of which an illustrated description was given in the "JOURNAL" for Aug. 8, 1916, p. 256] was erected by the Glasgow Corporation primarily for the purpose of testing its suitability for the production of smokeless fuel and illuminating gas. There being many unknown conditions to meet, the plant was constructed so that it could be operated in several ways. The Maclaurin producer or retort differs from all existing producers in its great height, and in having a condensing chamber well above the combustion zone, wherein any condensing oils are trapped and prevented from trickling down to the highly-heated fuel below. At Port Dundas, in order to make a smokeless fuel as free from ash as possible, a second producer was built alongside the main one; and the hot gases from this producer were used to degasify the coal passing down the principal producer. A single producer is now being used. When experimental work was stopped at Port Dundas, owing to the difficulties created by the war, certain fairly definite conclusions had been arrived at. The principal ones were:

(1) Coal could be turned into smokeless fuel by the passage through it of from 13,000 to 20,000 c.ft. of hot power gas. This is much less than was generally believed to be necessary. It is doubtful if this result is even now accepted.
(2) An easily kindled smokeless fuel could be obtained, containing not more than 4 p.ct. of volatile matter.
(3) In true low-temperature carbonization, the yield of rich gas was very small, being probably not more than one-half of what was generally believed.
(4) The oils obtained were highly complicated bodies, difficult to investigate by distillation, as they appeared to suffer decomposition on re-distilling, giving rise to new products.
(5) Ammonia was obtained in fair quantity; but while the liquors were free from ferrocyanides, sulphocyanides, &c., they always contained certain complex polyhydric phenols, capable of dyeing iron-mordanted wool a deep slate grey.
(6) The most important conclusion of all, however, was that a plant of this type could work with coking coals without sticking-up—a difficulty which had been almost universally predicted by all those experienced in coal carbonizing.

The quantity of power gas, smokeless fuel, oil, and ammonia made were in a commercial sense quite satisfactory; but there were two grave weaknesses: (1) The smokeless fuel, when put on a fire, crackled and sparked very badly; (2) the oil was of such an unknown composition that no firm could be found to offer a reasonable price for it.

The sparking of the smokeless fuel was known to be due to the red-hot coke dropping down into the water-seal; but without dismantling the plant to its foundations, this could not be done away with. During the war, this was not possible at Port Dundas; but a small plant was built at Stirling capable of carbonizing 1 cwt. of coal an hour. The plant confirmed the results obtained at Port Dundas in every respect, besides proving that a non-sparking smokeless fuel could be readily and safely discharged without the intervention of a water-seal.

At Stirling, also, a more systematic investigation of the oils was initiated than had before been possible. The results indicated the desirability of continuing the investigations on a larger scale; and two companies were formed—Maclaurin Carbonization, Ltd., to continue the experimental work on carbonization; and Scottish Bye-Products, Ltd., to continue the investigation on liquors and oils. A suitable site was obtained at Grangemouth; and a full-sized producer and plant for dealing with the bye-products obtained therefrom was erected.

More difficulty was experienced in obtaining uniformly coked material with the new plant than had been the case at Port Dundas; but at the end of 1920, the reason for this was discovered and overcome. At the Grangemouth plant, the coke is discharged without coming into contact with water, after a period of cooling within the plant.

Non-coking coals and coals with a lower coking index have been tried at Grangemouth than were tried at Port Dundas. Among the trials, churls obtained from five seams, all with a coking index below 9, were put through. In this case, there was no binding together of pieces of coal. The churls came out very much as they went in, so far as appearance was concerned; but the smokeless fuel was considerably harder than the original coal. Very little breaking-down of the coal took place in the plant. The coal was passed through the plant at the rate of 1 ton per hour. With a total production of 20,000 c.ft. of gas per ton of coal, a black smokeless fuel resulted; with a make of from 30,000 to 40,000 c.ft. of gas, a hard silvery coke was obtained.

The first wagons of smokeless fuel were sent to Glasgow and used for boiler-firing, with the satisfactory result that it brought

an inquiry for what would have been nearly the yearly output of the single unit erected. For boiler purposes the fuel, indeed, appears to be ideal. It is much more active than gas-works coke, as is evidenced by its ease in kindling. Being perfectly smokeless, the fireman is free from the fear of prosecution, even in a city like Glasgow. Moreover, he never requires to alter his fire-doors, as there is no rapid evolution of hydrocarbons—the fire being always a practically pure carbon fire.

It may be recalled that smokeless fuel from the Maclaurin plant contains only about 4 p.ct. of volatile matter. It would seem reasonable to anticipate that this fuel should fetch more in the market, purely from its efficiency standpoint, than the coals of 30 to 40 p.ct. volatile from which it is prepared.

A rough idea of the distribution of the heat units of the coal in the products is given below. Taking the coal to be a 12,000 B.Th.U. coal, a ton would thus contain 26,880,000 B.Th.U.

—	B.Th.U. Contained.	Value of Products.
		s. d.
20,000 c.ft. of gas at 200 B.Th.U.	4,000,000	6 8
20 gallons oil at 170,000 B.Th.U. per gallon.	3,400,000	12 9
12 cwt. coke	17,600,000	22 0
Loss in process	1,880,000	—
Ammonia, 24 lbs. at 1d.	—	2 0
	26,880,000	43 5

If the value of the original coal at the colliery is taken at 33s. 6d. per ton, each therm contained in it would cost 1½d.

The commercial values in the above table are taken on the basis that the coke is of the same value, therm for therm, as the coal; that the gas is worth 2d. per therm, owing to the saving in labour secured by its use; and that each therm in the oil is worth three times as much as each therm in the coal. The relation of the price of oil and coal for some years back would indicate this as about their relative values. In the above estimate, the consumer of the smokeless fuel is obtaining his fuel per therm at the same price as coal; but he will utilize effectively a larger percentage of its heat energy, whether consumed in a domestic fire or in an industrial boiler. This, therefore, would result in a certain conservation of fuel reserves.

The loss of energy in the production of the smokeless fuel varies; but 7 p.ct. is probably as low a loss as is possible in any carbonizing process. The capital cost of the plant leaves very little room for further economies; while repairs, depreciation, and running costs are also very low. The labour charges could be considerably reduced in large installations with labour-saving appliances.

The following figures are provided, based on present costs and prices: Capital cost of plant to carbonize 100 tons of coal per day = £20,000. At 30,000 tons per annum, this would be about 13s. 4d. per ton of throughput. Allowing 10 p.ct. for depreciation and 10 p.ct. for repairs, stores, and running charges, 5s. per ton for labour and 33s. 6d. per ton for coal, the following cost per ton is obtained:

	s. d.
Coal per ton	33 6
Labour per ton	5 0
Depreciation at 10 p.ct.	1 4
Maintenance and repairs	1 4
	41 2
Margin of profit	2 3
	43 5

This works out at 16½ p.ct. on the capital invested. This estimate omits any extra values which may be obtained in working-up the products, and is practically based on fuel values only, apart from the ammonia. It is sufficient to show, however, that the production of smokeless fuel to meet the nation's requirements may now be within the region of commercial success.

The foregoing results relate solely to the use of coals with a low ash content, as only such are suitable for the manufacture of a high-quality coke; but the same plant can also be run without alteration as a producer for the production of power gas, oil, and ammonia, or in the case of shaley material it can be run principally for the production of oil and ammonia. At Port Dundas the plant was tested on fuels with from 4 to 20 p.ct. of ash; while at Grangemouth fuels with over 50 p.ct. of ash have been tested.

Dry Ammonia.—The "Journal of the Franklin Institute" says that, if dry ammonia be passed into a heavy-walled bottle, which is provided with an inlet-tube and an outlet-tube (each containing a stopcock), and is almost filled with anhydrous ammonium thiocyanate, the salt acts as an absorbent for the ammonia. The temperature must be kept at 0° C. An absorption occurs; a liquid is obtained. This liquid contains approximately 45 p.ct. of ammonia when saturated with that gas at atmospheric pressure and a temperature of 0° C. The absorption is extremely rapid. The ammonia may be stored in this manner, and may be drawn off in the anhydrous state through the outlet-tube. The pressure at which delivery occurs depends on the temperature; and the latter is readily controlled by means of a water bath in which the bottle is placed.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

"Field's Analysis."

Sir,—At the risk of again being designated his "flattering friend," I must say of Mr. Harry Jones that he is too good a citizen to evade the law, and too true an engineer to measure-up his work with an elastic rule. For the undertakings which have taken advantage of the Gas Regulation Act, 1920, his favourite unit of gaseous energy (the thousand cubic feet) is no longer legal. As a measure, such a unit during the last seven years has been "stretched" out of all usefulness, and is never likely to be reinstated.

Does not my friend overlook the fact that in London, at any rate, a recording calorimeter might have been prescribed by the Referees long ago, without such a concomitant and radical change in gas nomenclature as formed the basis of the recommendation of the Fuel Research Board of the Department of Scientific and Industrial Research? If the recommendation settled anything, it was most certainly the unreliability and unfairness of "dear old Field's" standard of comparison—the thousand cubic feet.

It is a curious fact, by-the-bye, that the elder Field fell (or walked) into a similar trap to that which my friend so pleadingly urges Mr. Ibbs to enter. When he first published his tables, some of the companies were distributing, through two sets of mains, common and cannel gas. The Chartered made as much as 25 p.ct. of the richer quality. But Field worked-out all his figures on the basis of gas sold, quite regardless of this difference in quality; and I cannot but think that this is the very error Mr. Ibbs is being asked to perpetuate.

The cost of gas is to-day far too high. Mr. Ibbs, as much as any man, can help us in our task of bringing it down, by giving us true and accurate comparisons and values in the tables he prepares. We have each to declare our thermal value, and the Referees are going to see that we adhere to it; and I am confident that those of us who believe in the tenets of the newer school of thought (even though we may have long outgrown our claim to membership), will need no other basis of comparison than therms made, purified, stored, distributed, sold, &c. Moreover, an investigation of tables of working based thereon will do more than guessing, or speculating, or even "wangling" in helping us to solve that most knotty question of the best standard to adopt for our respective distributions of gaseous energy.

I fully sympathize with the chairman of a neighbouring company who, having been able to take pride in selling the cheapest gas in London, is now reminded that as "all is not gold that glitters," so "all is not gas that registers."

But I can assure him that our staff, indoor and outdoor, is already doing its thinking in terms of therms, and that the consumers are rapidly assimilating the new method. We shall soon be ready to attach to every prepayment meter, as sent out, a scale showing gas paid for in therms; and I cannot think it will be long before some such arrangement is incorporated with every meter.

Do not be led away, Mr. Ibbs, by my old friend's persistent imploring, and turn a deaf ear to his Latin—it is only a red herring.

Charles Carpenter.

South Metropolitan Gas Company,
Aug. 16, 1921.

Sir,—Please correct the printers' error in the commencement of the fourth paragraph of my letter in your current issue [p. 329]. As I confessedly write badly, I had the letter typed that: "The only benefit the new system gives is the continuous record of the *quality*," &c. (not *quantity* as printed).

The alteration is most unfortunate, as, like some misprints in previous letters, it makes nonsense of the sentence, and destroys the whole force of my note. Will you clear this up, please? H. E. Jones.

Westminster, S.W., Aug. 12, 1921.

Calorific Values of Combustible Gases.

Sir,—The comment on p. 316 of your number of the 10th inst. rather conveys the impression that there is difference in the respective values of the calorific value of certain combustible gases as quoted by Prof. Cobb in the issue in question and those given by me in a recent communication read before the Institution of Civil Engineers, and quoted by you in the "Journal" of June 29. The paragraph in question would lead one to suppose that the calorific value of some of the constituents of coal gas was uncertain to the extent of about 2 p.ct.

As the exact determination of calorific values has become of extreme importance in view of recent legislation, may I point out that this is by no means the case, and that there exists no discrepancy between the values given by Prof. Cobb and myself? Even the most casual reading of the respective tables would resolve the apparent discrepancy. Prof. Cobb specifically states that his members refer to 1 c.ft. of gas at 60° Fahr. and 30 in. *moist*. I equally specifically state that the members I quote refer to 1 c.ft. of gas at 60° Fahr. and 30 in. *dry*. For exact scientific purposes, it will, I think, be universally agreed that calorific values should be stated per unit volume of *dry* gas. In any case, the use of the term "moist," to signify saturated with water vapour at the specified temperature, is to be deprecated.

I have had occasion recently to examine critically the experimentally determined values of certain of the physical constants of the gases occurring in coal gas. Such an examination has led to the conclusion that the value of the calorific value of methane derived from the most reliable of the physical constants involved is 1017 B.Th.U. gross per cubic foot (dry), measured at 60° Fahr. and 30 in. pressure, as previously given by me in the paper referred to. This corresponds with 1000 B.Th.U. per cubic foot, saturated with water vapour at the temperature and pressure specified—a value intermediate between the lower (992 B.Th.U.) and the higher (1004 B.Th.U.) values quoted by Prof. Cobb. This, and kindred other matters dealing with the calculation of calorific values of gaseous mixtures from the composition—more

especially errors arising from the assumption of a constant gram-molecular-volume in the case of all gases, and the assumption that the unsaturated hydrocarbons may be regarded as propylene, an assumption on which the value quoted by Prof. Cobb for the "hydrocarbons" is based—are treated in the section devoted to "Gas Analysis" which has been contributed by Mr. Hollings and the present writer to the eleventh edition of "Sutton's Volumetric Analysis," now in the press.

In conclusion, may I be permitted a remark in regard to the determination of benzene and its homologues in coal gas? In the light of quite recent developments, I cannot subscribe to Prof. Cobb's opinion, as quoted, that "probably everyone will agree that there is no really satisfactory method." Dr. N. R. Campbell, of the General Electric Company, in a recent communication to the Physical Society, described an entirely new method of analysis, whereby such constituents can be readily detected and expeditiously determined quantitatively. The method is based upon the variations of the thermal conductivity of the gaseous mixture when any constituent is removed therefrom by subjecting the gas to successively lower temperatures. In a letter to the present writer, Dr. Campbell remarks that the method would in all probability be equally effective even for the quantitative determination of ethane and methane in the presence of one another—a determination effected only with extreme difficulty by any method hitherto employed, such as that of fractional combustion.

J. S. G. THOMAS.

South Metropolitan Gas Company,
709, Old Kent Road, S.E., Aug. 10, 1921.

[No such idea as that suggested in the first paragraph of this letter was in mind in quoting Dr. Thomas's figures for the calorific values of certain combustible gases. Perhaps it would have been well to have mentioned that his figures were on the "dry" basis, and that Prof. Cobb specifically referred to "moist." However, as Dr. Thomas remarks: "Even the *most casual* reading of the respective tables would resolve the apparent discrepancy," and later it is observed that "in any case, the use of the term 'moist,' to signify saturated with water vapour at the specified temperature, is to be deprecated."—ED. "G. J."]

REGISTER OF PATENTS.

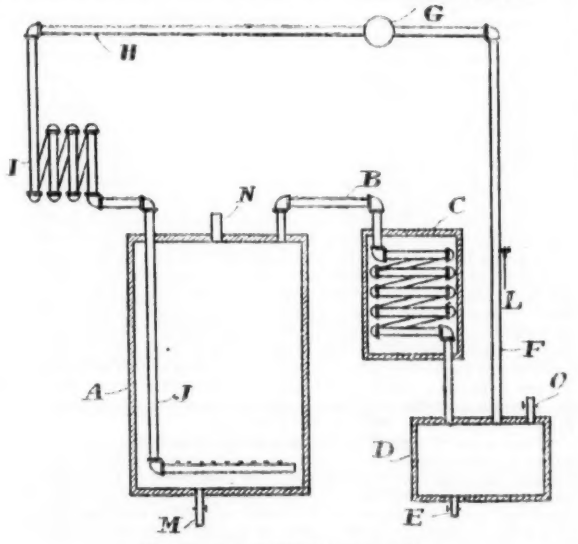
Distillation of Tar.—No. 158,852.

THE BARRETT COMPANY, of New York City, assignees of J. M. WEISS, of New York.

No. 9506; April 1, 1920. Convention date, Feb. 7, 1920.

In the distillation of tars, the patentee remarks that a progressive decomposition takes place as evidenced by the formation of a material high in carbon content and commonly known as "free carbon." In the distillation of these tars, the greater the formation of "free carbon" the less the yield of distillate oil and the greater the residual pitch.

It is known to pass air or other gas through heated tar during distillation with a view to carrying off volatilized hydrocarbons; and it has been proposed to circulate continuously through the apparatus the carrier gas. It has also been proposed to use for the purpose, without continuous circulation, gases which are substantially free from oxygen, which gas is soluble in the tar and has a chemical action upon it.



Weiss's Tar-Distillation Apparatus.

The process, according to the present invention, consists in repeatedly circulating through the hot tar a body of gas which is incondensible at 0° C. and atmospheric pressure, and which is inert to, and insoluble in the tar. The increased yield of oil is more pronounced the further the distillation is carried, and in general reaches proportions of real practical importance when pitches are obtained which have melting points of approximately 170° Fahr., although quite marked differences have been noted at all states of the distillation process.

As illustrative of how the process referred to can be applied to tar distillation, reference is made to the appended diagram.

A still A is heated by any suitable means and provided with a draw-off M; and a filling line N is connected by a pipe B to a condenser C, which delivers into a receiver D with a draw-off E. From the top of the receiver, a pipe F leads to a pump G, and thence, by a pipe H, to a superheater I, and by the pipe J to the bottom of the interior of the still communicating with it through the perforated pipe K. The inlet pipe O serves as a vent or for the introduction of gas into the system. The arrows L show the direction of gas-flow.

The still is charged with the tar to be distilled, the pump G started, and a suitable gas is drawn in through O until the system is filled. The system is then closed and heat applied—the gas being circulated at the desired rate. Distillation is continued with the circulation maintained until the residue in the still is of the desired consistency; the volatile constituents being carried off by the circulating gas from the still and condensed. The heat and gas circulation are then discontinued, and the residue is removed from the still.

The process is independent of the size or type of still used, the type of setting, the method of heating, the type of or means of cooling the condenser, &c. The important factor is that the body of gas used shall be repeatedly circulated and have the proper physical and chemical characteristics.

The following data illustrate the results which may be obtained by the use of the process in the distillation of a bye-product coke-oven tar as compared with some of the known processes. The particular tar used had a free carbon content of 8·5 p.ct. The passage of gas in all cases was made at the rate of about 15 c.ft. per minute per 100 gallons of material introduced into the still:

—	Percentage by Weight of Oil Obtained.	Percentage by Weight of Pitch Obtained.	Pitch Air Melting Point.	Pitch Percentage Free Carbon.
Distillation without agitation.	40·1	57·8	280° Fahr.	40·7
Air used not recirculated .	33·0	63·0	286° ,,	35·1
Nitrogen recirculated . . .	52·0	46·4	277° ,,	27·2
Carbon dioxide recirculated .	51·2	46·7	270° ,,	28·2
Mechanically stirred . . .	40·0	57·9	300° ,,	46·5

An obvious advantage is that in the ordinary distillation of a tar to a hard pitch, it is advisable to stop the distillation at a pitch of about 280° Fahr. melting point; for above this point there is a very decided tendency to form coke upon the shell of the still with the consequent danger of blistering or buckling due to the poor heat transfer to the body of the charge. Such action is indicated by the data given above.

On account of the relatively small carbon formation resulting from this process, the distillation may be carried to such an extent that a pitch of a much higher melting point may be produced without endangering the apparatus; and consequently a much greater yield of oil may be obtained than by methods already known. There is less of the oil decomposed, and the oil can be more completely removed from the pitch than was the case with prior processes.

Moreover, the highest melting point of pitch obtained in the past in practical plant operations has not been over 320° Fahr. determined as referred to above. There are statements in literature that it is possible to obtain coal-tar pitches with fusing points as high as 345° Fahr.; but the further statement is made that these are rarely if ever met with in practice—indicating that such pitches, if made, were only the result of laboratory experiments. By this method pitches of a melting point of 350° to 600° Fahr. can be obtained; and these are capable of being removed from the stills without difficulty or undue coking on the shell of the still.

Manufacture of Coal Gas.—No. 165,581.

MEADE, A., of Blackheath, S.E.

No. 10,971; April 20, 1920.

This invention in connection with the manufacture of coal gas, and the treatment of the liquid bye-products therefrom, comprises means whereby the quality of the gas is controlled, and the proportion of inert constituents is reduced. The patentee also claims it as an "auxiliary function" to provide suitable means for continuously removing the tar and liquor as condensed in the hydraulic mains, "to effect their continuous hot separation and to preclude the formation of pitch-like deposits."

The illustration (p. 390) shows the general arrangement of the retort-bench, hydraulic main, pressure box, and other accessories.

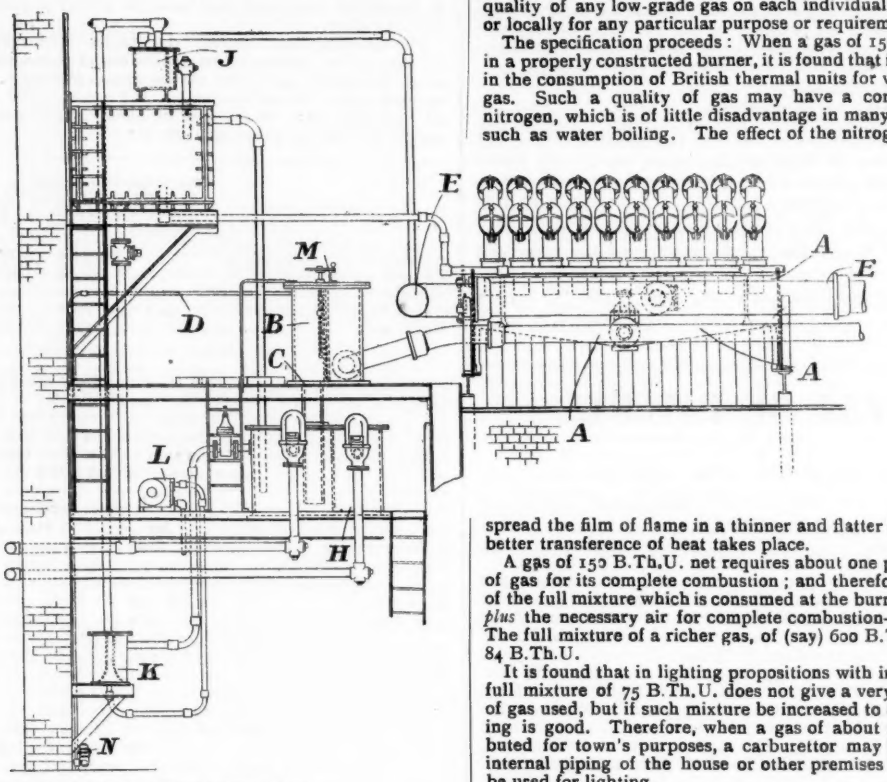
The tar and liquor flow from the hydraulic main A (behind the foul main E) by gravity through a take-off or connecting pipe A^1 direct to a pressure box B. The overflow C from the pressure box is some 12 in. to 16 in. below the normal height of liquid in the hydraulic main—thus an appreciable fall is provided to the pipe conveying the tar and liquor. The level of the liquid in the hydraulic main is maintained by causing a supply of gas under pressure (conveyed by the pipe D from the inlet of the purifiers or other suitable point) to bear upon the surface of the liquid in the pressure box. The hydraulic main, connecting pipe, and pressure box thus form a U-tube system, with one limb lower than the other. It is necessary to maintain the liquor at a higher level in one branch than in the other, which is effected by causing a pressure of between 12 in. and 18 in. to bear upon the surface of the liquid in the pressure box or lower branch. The pressure gas, prior to its entry into the pressure box, is passed through a controller N, whereby the pressure (once adjusted) is maintained constant. On the other hand, the controller provides means for regulating the pressure so that the difference in level between the liquid in the hydraulic mains and that in the pressure box may be varied at will, and any desired depth of seal may be obtained on the dip pipes, which may also be worked without a seal.

It has been previously proposed, the patentee remarks, to vary the depth of the seals on the dip-pipes by altering the gas pressure on the liquid in a vessel connected by a pipe to the hydraulic main; but then every hydraulic main is fitted with some form of U-chamber and

is modified by the addition of a pipe connecting it to the U-chamber, and is provided with pipes supplying gas pressure and also with means for regulating the seals either on individual dip-pipes or on individual hydraulic mains.

The apparatus according to the present invention differs from previous arrangements in that no alteration need be made to any existing hydraulic mains, and the whole of the pressure regulation is effected by introducing a single pressure box, which is distinct from the hydraulic mains, and suffices for any number of mains, as the adjustment of the seals by the single pressure box affects every dip-pipe in all the hydraulic mains in the same manner. The pressure box also forms a continuous draw-off arrangement for tar and liquor.

Later on in his specification, the patentee says: In ordinary methods of gas manufacture now employed, the quality of the coal gas is regulated by altering the vacuum on the foul main and thereby on the retorts; and it is excessive vacuum (and particularly fluctuations) which mainly give rise to the presence of inert constituents in the gas. This invention provides that the vacuum on the retorts is always maintained constant, but the quality of the gas is regulated by varying the



Meade's Coal Gas Manufacture Plant.

depth of liquid in which the dip-pipes through which the gas passes into the hydraulic main are sealed. Thus, by increasing the pressure in the pressure box, the liquid in the hydraulic mains is raised to a higher level, thereby increasing the seal on the dip-pipes and improving the quality of the coal gas. Conversely, when the pressure is reduced, the level of the liquid in the hydraulic main falls, thereby reducing the seal in the dip-pipes. Thus the whole control of gas making is effected by regulation of the controller N.

After leaving the pressure box, both the tar and liquor pass to a separator H, where they are separated while in the hot state and at the critical temperature at which separation is best effected—a portion of the hot liquor being raised to a separator J, flowing thence into the tank below, from which it is returned to the hydraulic mains. Thus continuous circulation is ensured, the quality of the tar is improved, and the gas is partially purified. The liquor for re-circulation is raised to the separator by a gas lift K supplied by gas under pressure from a compressor L. Gas separated from the hot liquor in J is returned to the foul main E.

The invention, therefore, provides a system of pressure control by means of high-pressure gas, whereby the usual method of controlling the quality of coal gas by regulating the vacuum on the retorts is dispensed with, and control is effected by introducing a single pressure box which is entirely distinct from the hydraulic mains, and by varying the depth of liquid in which the dip-pipes are sealed. At the same time, the system provides for the continuous drawing-off of tar and liquor and their hot separation at the critical temperature—the main feature of this continuous removal being that the tar and liquor are always flowing downwards, and are not caused to ascend as in existing continuous systems of removal.

It has been found that the yield of gaseous thermal units per ton of coal and per retort may be increased if the dip-pipes are unsealed and a vacuum of some 5-10ths of an inch of water column is worked when the retort doors are closed. When working on this principle, the retort-house governor has to be adjusted so that the draw is reduced to about 1-10th of an inch when the doors are open.

The application of the invention to this principle of working, it is said, enables the operations to be simplified, for by adjusting the controller N the dip-pipes may be slightly sealed while the retorts are being charged and discharged; and no alteration of the retort-house governor is necessary. The invention is also advantageous during temporary stoppages of the gas plant—*e.g.*, on Sundays. In such cases the pressure at the inlet of the purifiers may fall considerably and may no longer suffice to maintain the seal on the dip-pipes; but by adjusting the hand-wheel M, fitted to the top of the pressure-box B, the normal conditions of seal will be maintained—the tar and liquor flowing away temporarily over a weir plate.

Manufacture, Utilization, and Combustion of Fuel.

No. 166,212.

HELPS, G., of Nuneaton.

No. 6956; March 20, 1919.

One object of this invention (in the words of the patentee) is to supply a low-grade gas or a richer gas through the same main pipes. For instance, a low-grade gas could be distributed and used for the purposes for which it was suitable as a low-grade gas and carburetted for purposes that required it. Also to provide means for increasing the quality of any low-grade gas on each individual consumer's premises or locally for any particular purpose or requirement.

The specification proceeds: When a gas of 150 B.Th.U. net is used in a properly constructed burner, it is found that it is just as economical in the consumption of British thermal units for work done as a richer gas. Such a quality of gas may have a considerable content of nitrogen, which is of little disadvantage in many heating operations—such as water boiling. The effect of the nitrogen is found to be to spread the film of flame in a thinner and flatter layer, and therefore a better transference of heat takes place.

A gas of 150 B.Th.U. net requires about one part of air to one part of gas for its complete combustion; and therefore the calorific value of the full mixture which is consumed at the burner-head—*e.g.*, the gas *plus* the necessary air for complete combustion—is about 75 B.Th.U. The full mixture of a richer gas, of (say) 600 B.Th.U. would be about 84 B.Th.U.

It is found that in lighting propositions with incandescent mantles a full mixture of 75 B.Th.U. does not give a very good result per foot of gas used, but if such mixture be increased to 84 B.Th.U. the lighting is good. Therefore, when a gas of about 150 B.Th.U. is distributed for town's purposes, a carburettor may be introduced on the internal piping of the house or other premises in which the gas is to be used for lighting.

If necessary, the whole of the piping in the house may be so arranged that the fires and cooking rings, cooking-stoves, water-heaters, &c., are supplied from a pipe on the outlet of meter or service without carburation—the burners requiring an increased quality of gas being connected on to different branches on which carburettors are attached.

Hitherto gas has been supplied for town's purposes as made and distributed from the gas-works; and thus one quality of gas, and that a comparatively high quality, has been used for all purposes. By a system of carburetting a low-quality gas when required for lighting purposes, or such purposes that demand a slightly increased quality for the best results, immense economies are effected. For example, about 150,000 c.ft. of gas of 150 B.Th.U. may be made from inferior coal, or the like, in an ordinary producer having few refinements, but from which tar and ammoniacal liquor are obtained as bye-products; and this gas is quite suitable for cooking, water heating, gas-engines, gas-fires, and the like. With this gas a fire consuming 40 c.ft. per hour on an average may be alight for 3700 hours, or nearly five months, on a total consumption of 150,000 c.ft. A coal-fire using only 1 lb. of coal per hour for this length of time would use 1 ton 13 cwt. The gas-fire will require no labour; and if the price of gas be reckoned at 6d. per 1000 c.ft., which would allow a substantial profit, its cost to the consumer would only be £3 15s., while the cost price of gas at 1s. 5d. per 1000 c.ft would only be 18s. 9d.

Where a gas of a quality over 240 B.Th.U. is concerned which required carburetting for flat-flames and to improve the light with incandescent mantles, this invention is also applicable. The carburettor used may take any known form—for example, the gas may be carburetted as made by means of heavy oils, as used in the case of carburetted blue water gas, or by means of rich coal gas or of benzole or of petrol, or benzole or petrol may be added afterwards.

Coal may be carbonized on the consumers' premises and rich gas made, or oil gas may be made and added there. In this way, the pressure at which the gas is distributed supplies the power for the carburetting. The majority of uses to which gas is put only require a low-grade gas, so that the enrichment of a small volume for special purposes can be carried out very economically. When required, a rich gas may be mixed with the distributed low-quality gas on the consumers' premises. For all domestic uses, an oil carburettor will do all that is necessary.

This invention allows a rich gas to be diluted down to a particular quality, or a poor gas to be enriched up to a particular quality.

Gas Manufacture.—No. 166,497.

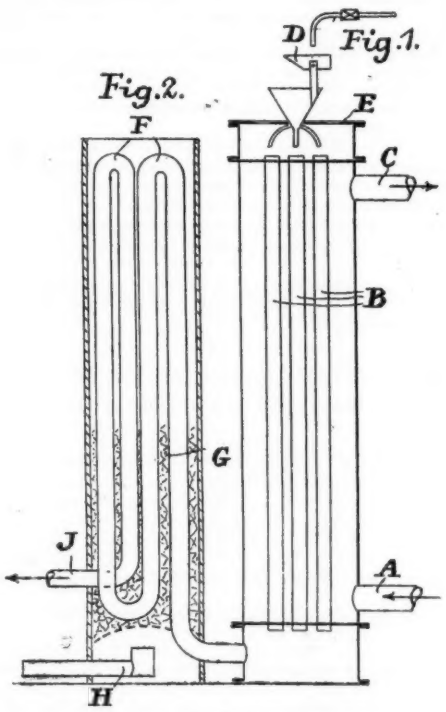
HELPS, G., of Nuneaton.

No. 8631; March 30, 1918.

This invention relates to plant for the manufacture of gases—such as producer gas, semi-water gas, or blue water gas—as described in patent No. 156,812, and "has for its object the economical production of superheated steam for use in a producer."

Apparatus for the purpose consists of vertical tubes heated by the hot gases produced during the manufacture of the gases named, and to which water is fed. The steam so produced is superheated in a tube or tubes embedded in or surrounded with refractory material. Preferably the tubes are open-ended, and each tube is automatically and periodically supplied with a regulated quantity of water; and during the period in which water is not supplied air may be drawn in.

If desired, before entering the heater, the producer gases may pass through vessels containing incandescent coke or chequerwork into which tar or other means of enrichment may be brought, or the gas be otherwise treated. By this means any carbon dioxide present is converted into carbon monoxide. The effect of using air or steam at a high temperature is to reduce the quantity of air required, due to the heat absorbed by the producer, and the result is said to be an increase in the calorific value of the gas.



Helps's Gas-Manufacturing Plant.

Fig. 1 shows a sectional elevation of a heater, by means of which steam is generated and air heated-up before reaching the producer. The gases from a generator enter at A and pass upwards round the outside of the tubes B (surrounded by or formed of refractory material), imparting heat to the steam and air inside the tubes before leaving by the connection C; water being admitted by a tippler arrangement and air through openings in the top cover E. The tippler D remains in a horizontal position when empty, but tips when the level of water dripping therein from the pipe above reaches a predetermined amount. When tipped the water flows into a funnel below.

The hot steam and air are drawn from the heater by an exhauster into a superheater (fig. 2), in which there is a coil F formed of or surrounded by refractory materials G heated by the burner H. The steam and air are thus raised to a very high temperature before passing on to the producer through the connection J. The temperature, when tubes of refractory materials are used, may thus be raised to 1000° Fahr. or more.

Bradford's Gas Centenary.

It is a hundred years ago this summer since lighting in Bradford began to change from oil to gas, consequent on the formation of the Bradford Gaslight Company, whose effort to raise £15,000 capital had to be helped-out by Leeds merchants, owing to many Bradfordians being very doubtful as to the safety of investment in the new-fangled lighting method. The Company had a rough passage in the early days, both against the difficulties of gas making and against the financial handicaps, which prevented them from paying dividends for some time. But in 1822 they obtained a substantial lift by authority from the Board of Commission to light the streets by gas, at a cost of £212 per year, for a period of fourteen years. This cost was less than the previous outlay on oil lighting. In later years the Company prospered; and in the summer of 1871—fifty years after the formation of the Company and the start of gas lighting in the town—the Corporation took over the gas undertaking, which is now one of the biggest and most up-to-date in the country.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

Leicester Corporation Bill: Reported, with amendments.

Burnley Corporation Bill and Wigan Corporation Bill: Read the third time, with the amendments; further amendments made; and returned to the Commons. Returned from the Commons, with the amendments agreed to.

Batley Corporation Bill: Read the third time, with the amendments; passed; and returned to the Commons.

Rotherham Corporation Bill: Returned from the Commons, with the amendments agreed to.

GAS REGULATION ACT.

Applications for Special Orders under Section 10.

Approval was given in the House of Lords last week to the motions standing in the name of Lord Somerleyton in connection with the drafts of eight Special Orders proposed to be made by the Board of Trade under section 10 of the Gas Regulation Act, 1920. His Lordship explained that, under the provisions of section 10 of the Act, the Board of Trade had power to make Special Orders with respect to various matters relating to gas undertakings. The section provided that before any such Order was made it should be laid in draft before both Houses of Parliament; and it should not be made unless both Houses, by resolution, approved the draft, either without modification or addition or with modifications or additions to which both Houses agreed. One Order under the section had already been approved by Parliament, and made by the Board of Trade.

The eight undertakings referred to who are applying for the Special Orders are: The British Gas Light Company (Staffordshire Potteries Undertaking), the Glastonbury Corporation, the Harpenden District Gas Company, the Havant Gas Company, the Hindley Urban District Council, the Ossett Corporation, the Pontypool Gas and Water Company, and the Stoke-on-Trent Corporation.

In connection with the Harpenden Gas Company's Order, Lord Somerleyton explained that there were several amendments which it was necessary to submit for the approval of Parliament. All but one of these were rendered necessary by the fact that the draft Order was presented to Parliament on June 14; and it was anticipated that the approval of both Houses would have been obtained before the Order applied for by the Company, under section 1 of the Gas Regulation Act was made. It became necessary, however, to issue the latter Order before the end of June; and, as the Order altered the basis on which the Company were authorized to charge for their gas, certain consequential drafting amendments were required in the present Order. The amendment to clause 33 had been asked for by the Hertfordshire County Council, for whose protection the clause was inserted. It was agreed to by the Company, and the Board of Trade saw no objection to the omission of the words in question.

In the House of Commons on the same day the drafts of the eight Orders were introduced by Sir William Mitchell-Thompson (the Parliamentary Secretary to the Board of Trade), and approved.

HOUSE OF COMMONS.

Progress of Bills.

Rhymney and Aber Valleys Gas and Water Bill: Read a second time. The Standing Orders relative to the committal stage of Private Bills were suspended; and the Bill ordered to "lie upon the Table," Bill considered; and to be read the third time.

Rotherham Corporation Bill: Lords amendments considered and agreed to.

Burnley Corporation Bill and Wigan Corporation Bill: Lords amendments considered and agreed to.

Gas Regulation Act, 1920.

Copies were presented of drafts of Special Orders proposed to be made by the Board of Trade under section 10 of the Act on the applications of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company, Lea Bridge District Gas Company, North Middlesex Gas Company, Southgate and District Gas Company, Chelmsford Corporation, Ellum-cum-Greetland Gas Company, Redhill Gas Company, Thurstonland Urban District Council, Walker and Wallsend Gas Company, Welwyn, Knebworth, and District Gas Company.

Public Utility Companies (Capital Issues) Act, 1920.

A copy was presented of a report on an application to the Board of Trade under the Act by the Altrincham Gas Company.

Dissatisfaction at Shotts.—It has been decided by a largely attended public meeting at Shotts (Lanarksbire) to petition the County Council to provide an adequate lighting supply for the district. This step has been taken as a result of an increase of 2s. 6d. per 1000 c.ft. in the price of gas by the Stane and Dykehead Gaslight Company. The Company also intimated that consumers by slot-meter would pay a sum of 10s. per annum, instead of an increase per 1000 c.ft. of gas used. The action of the Company has been resented; and the decision to approach the County Council is the result. It is also recommended that the public should refrain from using gas. The Company have since withdrawn the proposal to increase the price, which remains at 7s. 6d. per 1000 c.ft.

MISCELLANEOUS NEWS.

LIGHTING IN FACTORIES AND WORKSHOPS.

Second Report of the Departmental Committee.

In January, 1913, the Home Secretary appointed a Committee under the chairmanship of Dr. Glazebrook (now Sir Richard Glazebrook, K.C.B.), F.R.S., D.Sc., to inquire and report as to the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the workers employed, and the various forms of illumination. In 1915, the Committee issued their first report, dealing with the general lighting of factories. Further inquiry was then postponed until after the war. In November, 1920, the Committee resumed their inquiries; and in January last Mr. C. Dampier Whetham, F.R.S., was appointed Chairman in succession to Sir R. Glazebrook, who felt obliged to resign the chairmanship owing to pressure of other work. The Committee includes Mr. Leon Gaster and Sir Arthur Whitelegge, K.C.B., M.D.

In presenting their second report, the Committee say that, on the resumption of their work, they received from the Home Secretary the suggestion that their attention should, for the present, be directed to defining the conditions necessary for securing suitable lighting, and to an inquiry into the effects of working in mixed natural and artificial light. In addition, the Home Secretary approved the suggestion that the Committee should proceed to classify processes according to the minimum illumination required, if it were possible to do this without, at present, incurring the heavy expense which detailed observations of the numerous processes of industry would necessarily involve. They have now considered the conditions necessary to secure suitable artificial lighting; and the requirements they recommend in the present report have been formulated with a view to their inclusion in an Order defining suitable lighting for all factories and workshops. In arriving at their conclusions, they have given consideration to the codes of lighting which now have statutory force in many of the American States, and to the recommendations for industrial lighting formulated by Illuminating Engineering Societies in America and Germany.

The Committee take the opportunity of pointing out that, generally speaking, one type of shade is adapted to one type of lamp only, and that, to maintain suitable lighting, change of type of lamp often necessitates a change of type or a readjustment of the shade. The requirements of suitable lighting are quite definite. They are absence of glare and of troublesome shadows, steadiness and constancy of the light source, together with a moderate degree of uniformity of illumination and of surface brightness over the plane of work. The subject is therefore considered under the three headings of glare, shadow, and constancy.

Glare.

The first essential of suitability is proper shading of the light sources. Many types of shades are now in use; and these vary considerably in efficiency. Some definition of the term "proper" shading seems, therefore, to be required.

The effect of a shade is to reduce the intrinsic brilliance of the source when seen through the shade; and proper shading could accordingly be defined by prescribing a maximum brightness for the shade not exceeding a given number of candles per square inch. This method, however, involves complicated measurement; and the Committee suggest, as a practical alternative, the simple criterion whether the incandescent filament, mantle, or flame is distinguishable as such when it is viewed through the shade.

So far as glare is concerned, the source need only be screened when in or near the direct line of vision, and then only in the direction towards the eye; and the Committee have accordingly considered the framing of a requirement which, without insisting on complete screening of the source, will ensure that no bright surface is visible except considerably away from the usual line of vision.

They think that in practice a suitable requirement might be expressed in terms of the distance of the source and of a limiting value of the angle between the line from the source to the eye and a horizontal plane, within which angle no such source should be directly visible. A certain amount of scientific evidence exists as to the most desirable angle for this purpose; and they have been guided by this in formulating their own requirement. In the case of sources used for general lighting, they consider that, for the purpose of a legal requirement, the limiting value of the angle specified should be 20°; but in the case of very near sources, such as are employed for local lighting, this angle is, in their opinion, too small to ensure absence of glare, and they think, therefore, that an angle of 30° should be substituted.

The Committee accordingly recommend that there should be a provision as follows:

(A) . . . "Every light source (except one of low brightness*) within a distance of 100 ft. from any person employed shall be so shaded from such person that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20°, or in the case of any person employed at a distance of 6 ft. or less from the source, not less than 30°."

One form of glare (which is common in factories where smooth or polished material is used) is generally caused by unsuitable placing of the source, and may be remedied either by changing the position of the source relatively to the eye, or by decreasing the diffusion of the light by enclosing the source in some diffusing material. They suggest the following simple requirement:

(B) . . . "Adequate means shall be taken, either by suitable placing or screening of the light sources, or by some other effective method, to prevent direct reflection of the light from a smooth or polished surface into the eyes of the worker."

* By "low brightness" is meant an intrinsic brilliance of not more than 5 candles per square inch.

Shadow.

Troublesome shadows are frequently to be found, even with systems of lighting which are good in themselves. They are generally due to unsuitable placing of the light sources, whereby the shadow of the worker himself or of some part of the plant or material is cast on the place of work, and are particularly objectionable when thrown by some object in motion. Apart from the annoyance caused and the interference with the proper execution of the work, deep shadows, by concealing dangerous parts of machinery, may lead directly to accidents.

The Committee recommend, therefore, that there should be a provision as follows:

(C) . . . "Adequate means shall be taken to prevent the formation of shadows which interfere with the safety or efficiency of any person employed."

Constancy.

Constancy in artificial illumination is a matter of great importance. Unsteadiness and flicker have an injurious effect on vision, and if pronounced increase the risk of accidents.

Under modern conditions, and with a modern system of lighting, this detrimental factor is unlikely to arise. The Committee are advised, however, that there are factories in which old-fashioned batswing burners are still in use (apart from instances where they are deliberately employed for special reasons—*e.g.*, on boring machines), or in which incandescent gas mantles are inadequately protected from draughts. Similarly, in some factories which are electrically lighted, flicker and variation in illumination may arise through fluctuations of the voltage available. Such fluctuations may possibly arise through the employment of alternating voltages of low periodicity.

The Committee think that flicker which can be remedied should be prohibited; and they accordingly recommend that there should be a provision as follows:

(D) . . . "No light sources which flicker or undergo abrupt changes in candle power in such manner as to interfere with the safety or efficiency of any person employed shall be used for the illumination of a factory or workshop."

Taking into account that extensive alterations may be necessary in many factories so as to comply with the requirements suggested, they recommend:

(E) . . . "That, as regards existing installations, a reasonable time limit should be given before the above requirements become operative."

PROPOSED PRIVATE WAGON OWNERS' REPAIRING AND MAINTENANCE ASSOCIATION.

A well-attended meeting was held last Monday week at the Cannon Street Hotel, at which there were present many of the largest owners of private wagons, as well as representatives from colliery companies. Mr. George Rose presided, and at considerable length outlined and explained the need for such an Association being formed. This was very apparent from a number of instances given by private wagon owners of the very high charges made by the existing wagon repairing associations.

There was some discussion as to whether the Association should be formed on co-operative lines; but this did not receive much favour from those present. The meeting, however, was unanimous that an Association should be formed as soon as possible and practicable; and a Committee was appointed to consider more particularly the raising of the necessary capital, and on what particular basis or lines the Association should be constituted. The Committee (which includes Mr. O. G. Eveson, of the G. J. Eveson Coal and Coke Company, of Birmingham, and Mr. F. G. Pilley, of Messrs. Stephenson Clarke and Co., of London) hope to hold a meeting before the end of the month.

Mr. Edwin A. Hart, of Nos. 11 and 12, Coal Exchange, London, E.C. 3, is the Acting Secretary; and to him all communications should be addressed.

PORTSEA ISLAND GAS LIGHT COMPANY.

The Half-Yearly Meeting of the Company was held last Thursday—Mr. W. Gillman, J.P. (the Deputy-Chairman), presiding, in the unavoidable absence of Mr. T. F. H. Lapthorn, J.P.

The Chairman, in moving the adoption of the report and accounts, said there had been a small increase in the gas sold, of 10 million c.ft. over the first half of 1920. The capital account showed an expenditure of £13,300 on buildings and plant—practically all of which was spent on the new manufacturing plant at Hilsea—making a total expenditure to date of £69,900, and leaving a balance of about £23,000 yet to pay. On revenue account, coal and oil had cost £19,429 more, partly owing to the coal stoppage, and partly to the advance of 4s. 2d. per ton in May, 1920, which together had increased the average price of coal by 7s. 2d. per ton in excess of last year; while the average cost of oil had been 3½d. per gallon more. During the coal stoppage, the price of oil was materially reduced, and they were able to use large quantities in place of coal. But for this, the fuel charges would have been much greater. The expenditure on repairs and maintenance of works was up to the extent of £7801, due to their still being engaged in overtaking repairs and renewals which it had been impossible to carry out during the war. But the amount was less by £6912 than the expenditure in the half year ended December last. On the receipts side, the sale of gas had produced £244,794, compared with £217,649, the bulk of which increase was due to the higher price. The receipts from the sale of coke had fallen by £12,705, because, though they obtained higher prices, the quantity produced was less, owing to the larger proportion of water gas made and the very inferior quality of the imported coal.

They had a profit on the trading of £24,989, which was transferred to profit and loss account; and after paying interest charges and income-tax, there was a balance of £26,757 available for dividend. They had not written-off anything from the extraordinary renewals suspense account (which remained at £7822), nor made the usual half-yearly transfer of £2258 to the insurance fund. But they had decided to recommend an increase in the dividend, which was one of the principal objects of the Gas Regulation Act. He believed they had now got over the worst of their difficulties, and that the shareholders, who (consequent on the reduction in the dividend during the last five years) had forfeited £57,241, were now entitled to some consideration. They were therefore recommending an increase which, though not to the full extent of the pre-war dividend, would give the bulk of the shareholders a return of 4½ p.ct. on the money which they had paid for their shares, as compared with a return of about 2⅝ p.ct. which they had been receiving of late. The Directors had hoped, with the increase in dividend, to have been able to announce a decrease in the price of gas; but they were unable to take this step while the price of coal remained at its present figure.

The report was adopted; and dividends for the half year were declared at the rates per annum (less income-tax) of 12 p.ct. on the "A" and "B" shares, 11 p.ct. on the "C" shares, 9 p.ct. on the "D" and "E" shares, and 5 p.ct. on the 5 p.ct. maximum stock.

The proceedings closed with a vote of thanks to the Secretary (Mr. H. A. Stibbs), the Engineer (Mr. Thomas Carmichael), and the staff generally, for their able management of the Company's affairs.

COAL STRIKE DIFFICULTIES IN GLASGOW.

The Gas Manager's Review.

In a report to the Glasgow Corporation on the maintenance of supplies of gas and coke during the coal strike, Mr. John W. M'Lusky, the General Manager, says that on April 1, when the coal strike commenced, the Gas Department had in stock 95,000 tons of coal, which was equal to about eight weeks' normal summer supply. During the month of April, a full supply of gas was maintained, and the coal used therefore amounted to almost 62,000 tons, representing a little over 2000 tons per day.

Consumers, through the public Press, were invited to co-operate with the department in the conservation of coal stocks by economizing in the use of gas. However, probably due to the shortage of solid fuel at the time, and a full supply of gas being available, the repeated appeals for economy did not have the desired effect, as was borne out by the records of the department, with the result that, towards the middle of May, on account of the rapid diminution of coal stocks, and there being no hope of an early resumption of work at the collieries, it was found necessary to restrict the supply of gas. On May 15 restricted hours of supply came into operation, whereby the supply of gas was reduced to the extent of 5½ hours per day. The effect of this was immediately to reduce the output of gas by about 50 p.ct. After a week's trial of these hours, it was considered advisable, in the interests of the citizens, to reduce the restricted period still further; and on May 20 another restriction took place, reducing the hours of supply to four, which resulted in a saving of about 65 p.ct.

If these restrictions had not been applied, it is quite possible the city would have been without a supply of gas, as on May 10, when the first cargo of imported coal was ordered by the department, the stock of coal at the gas-works had dropped to 14,000 tons—about eight days' normal summer supply. Fortunately, with the restrictions in the supply of gas, and the arrival of the first cargo of coal from Canada on the 24th of May, it was found possible to increase the hours of supply to seven hours, as from May 28, and further cargoes of imported coal, amounting in all to about 50,000 tons, having been received, the department were able to continue without making any further alteration in the restricted hours.

When the strike commenced, the stock of coke at the gas-works amounted to about 40,000 tons. This large stock enabled the department to meet the extraordinary demand for this fuel by industrial firms, bakers, and domestic consumers when the pits ceased work. During the month of April, and until the 10th of May, when the Fuel Committee rationed the supply of coke, the average quantity disposed of daily was about 1800 tons—this representing small supplies by measure, despatches by rail, and supplies uplifted by carts at the gas-works. The total stock of coke on May 10, which, of course, had been added to from production—had dropped to 4000 tons in forty days, and since then, excepting in very special circumstances, coke has only been available for bakers, public utility services, hospitals, and domestic consumers.

The rationing of coke on permit had the effect of reducing the daily output to about 300 tons, with the result that, with the restricted production of coke due to the reduction in the manufacture of gas, the department have been able to maintain the supply of coke to necessary services within the City. The stock of coke on June 29 was 223 tons.

Ownership of Railway Wagons.—A recommendation of the Perth Gas Committee that forty wagons should be acquired for the use of the Gas Department, and that application should be made to the Secretary for Scotland for authority to borrow £6000 for their purchase, caused considerable discussion in the Town Council. Mr. T. Hunter formally moved approval of the recommendation, and explained that the Gas Department had been working these wagons under a contract for ten years, and the contract expired next month. The hiring company were prepared to renew the contract, but at a greatly increased rate. Ex-Bailie Macpherson asked if it was absolutely necessary that they should have the wagons; and the Convener replied in the affirmative. After further discussion, it was agreed that the recommendation be remitted back until the Council could be fully informed on the question, and so that an estimate of the value of the wagons could be secured from an independent party.

GAS REGULATION ACT ORDERS.

The Director of Gas Administration has forwarded copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

British Gas Light Company, Ltd. (Norwich Station).

As from the declared date: (1) The maximum prices in respect of gas supplied by the undertakers shall be 17d. and 19·4d. per therm; and these prices respectively shall be substituted for the prices of 4s. 6d. and 5s. 6d. per 1000 c.ft. mentioned in subsection 2 of section 13 (price of gas) of the British Gas Light Company, Ltd. (Norwich) Act, 1918. (2) The figure 1·2d. per therm shall be substituted for 6d. in subsection 3 of the said section 13.

The words "per therm" shall be substituted for "per thousand feet" in section 29 (power to company to cause public lamps to be lighted if required by Local Board, &c.) of the British Gas Light Company, Ltd. (Norwich), Act, 1858. (Aug. 4.)

Cheltenham Gas Light and Coke Company.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 17·2d. per therm and 19·6d. per therm; and these prices respectively shall be substituted for the prices of 4s. and 5s. per 1000 c.ft. mentioned in section 5 (price of gas) of the Cheltenham Gas Act, 1872.

SPECIAL ORDERS.

The drafts have been issued of a further batch of Special Orders proposed to be made by the Board of Trade under section 10 of the Act.

Corporation of Chelmsford.

To authorize the Corporation to borrow a sum not exceeding £5000, to be paid off, with interest, within forty years from the date of borrowing.

Elland-cum-Greetland Gas Company.

To enable the Company to issue 7½ p.ct. redeemable preference capital and debenture stock; to grant pensions; to lay pipes for ancillary purposes; to regulate the supply of gas and charges therefor; and to supply gas in bulk.

Harwich Gas and Coke Company.

To authorize the Company to raise additional capital; to purchase further gas lands; to lay down pipes for ancillary gas purposes; to make superannuation and other allowances; to purchase or supply gas in bulk; and to regulate the supply of gas.

Lea Bridge District Gas Company.

To sanction the holding of annual instead of half-yearly meetings, and the payment of interim dividends.

North Middlesex Gas Company.

To regulate the conditions under which capital is issued; to provide for the holding of yearly meetings and the payment of interim dividends; to allow the appropriation of specified amounts to the reserve and special purposes funds; to appoint managing directors; to regulate the supply of gas; and to carry on profit sharing, grant pensions, &c.

Salisbury Gas Light and Coke Company.

To change the name to the Salisbury Gas Company; to extend the limits of supply; to permit the purchase of land and the raising of additional capital; to hold annual meetings and pay interim dividends; to appoint managing-directors; to grant pensions; to deal with bulk supplies; and to regulate the supply of gas.

Southgate and District Gas Company.

To make various financial provisions; to authorize the Company to hold annual meetings and pay interim dividends; to form a reserve fund; to appoint managing-directors; to supply in bulk; to establish profit-sharing, grant pensions, &c.; and to regulate the supply of gas.

Tunbridge Wells Gas Company.

To extend the limits of supply of the Company; to confirm an agreement for the purchase of the Southborough gas undertaking; and to enable the Company to purchase residual products and contract for the sale of gas in bulk. There are provisions for the settlement by arbitration of any differences as to liability for damage to the electricity works or property of the Tunbridge Wells Corporation and for the protection of the railway companies.

Welwyn, Knebworth, and District Gas Company, Ltd.

To enable the Company to raise new capital; to purchase additional gas-lands; to grant pensions; and to regulate the supply of gas, &c.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications by gas undertakings to the Board of Trade for Orders under the Gas Regulation Act.

Crowborough District Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

Lichfield Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. per 1000 c.ft. for gas supplied within a radius of 1½ miles from the Guildhall of the City of Lichfield, and 5s. beyond that radius. The prices they have asked the Board of Trade to substitute for these are 1s. 8d. and 2s. 1d. per therm respectively.

SPECIAL ORDERS.

Rushden and Higham Ferrers District Gas Company.

The Company are applying for an Order under section 10 of the Act to increase their capital powers and borrowing powers in respect of their existing capital.

Wellington (Salop) Gas Company.

Application has been made by the Company to the Board of Trade for an Order under section 10 of the Act, to empower them to purchase the undertaking of the Oakengates and St. George's Gas and Water Company, Ltd.; to create new shares or stock and borrow further money; to extend the limits of supply; to authorize the Company to apply for powers to supply electricity; and to make further regulations regarding the supply of gas.

DECLARATIONS OF CALORIFIC POWER.

British Gas Light Company, Ltd. (Norwich Station).—480 B.Th.U. (Aug. 24.)

Cheltenham Gas Light and Coke Company.—470 B.Th.U. (Aug. 15.)

CARLISLE GAS-WORKS REPORT.

Reporting to the Carlisle Corporation Gas Committee on the working results for the year ended March 31, Mr. J. E. Blundell (the Engineer and Manager) says the total quantity of gas made during the year was 432,215,000 c.ft., being an increase of 7,027,000 c.ft., or 1·65 p.ct., over the preceding twelve months. The quantity sold showed an increase of 2·4 p.ct. The average price was 8·35d. up, at 4s. 5·55d. per 1000 c.ft. The yield of gas per ton of coal carbonized was 11,223 c.ft., as compared with 11,748 c ft. in 1919-20. In the past year the average consumption per ordinary meter was 45,520 c.ft., and per slot meter 17,888 c.ft.

The financial results show a revenue expenditure for the year of £157,361, and an income of £169,002; being £54,631 and £34,019 respectively in excess of the corresponding amounts for the previous year. They are by far the highest revenue account figures in the history of the undertaking. The gross profit amounts to £11,640, which, after repayment of loans, income-tax, interest, &c., leaves a net profit on the year's working of £2456.

The second collier built by the Lytham Shipbuilding and Engineering Company for the Alliance and Dublin Consumers' Gas Company has been launched. The vessel was named the "Glencullen;" the ceremony being performed by Mrs. Grey, wife of Mr. W. J. Grey, the Secretary of the Company.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Aug.* 16.

In the London tar products market prices remain steady as last reported. There is most activity in pitch, creosote, and tar for roads. Sulphate of ammonia is without change.

Tar Products in the Provinces.

Aug. 15.

The report for the week ended Aug. 9 was not to hand at the time the last issue of the "Journal" was made up for press. Apart, however, from solvent naphtha, which was rather firmer, and for which prices might be considered to be 2s. 7d. to 2s. 8d., the figures given previously were absolutely unchanged.

The average values for gas-works products during last week were: Gas-works coal tar, 61s. to 65s. Pitch, East Coast, 80s. to 82s. 6d.; West Coast—Manchester, 77s. 6d. to 80s.; Liverpool, 77s. 6d. to 80s.; Clyde, 77s. 6d. to 80s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluol, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11½d. Solvent naphtha, naked, North, 2s. 8d. to 2s. 9d. Heavy naphtha, North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 9½d. to 9¾d.; salty, 8½d. to 8⅝d. Heavy oils, in bulk, North, 10½d. to 11½d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £20 to £30; salts, £7 to £9, bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

There is very little alteration in conditions of markets for bye-products since the last report. There is a keen demand in some directions, with general scarcity of products; but as a rule traders are indifferent. The demand for solvent naphtha is very urgent; but until the coke-ovens are working again it is difficult to see how the necessary supplies are to be produced. There has certainly been a material reduction in price of coke. In some directions, however, this is not thought to be sufficient to warrant a general re-opening of blast furnaces, without which coke-ovens are not likely to be fully employed. Pitch for forward delivery is in demand; but sellers are not disposed to make contracts at current rates. In the absence of coke-oven tar, the tar produced by the gas companies will not be sufficient to supply all requirements in pitch. The current value is about 80s. per ton. Creosote remains steady with a good demand of 9d. per gallon. Carbolic acid

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"READ THE PRESSURE BY THE POINTER."

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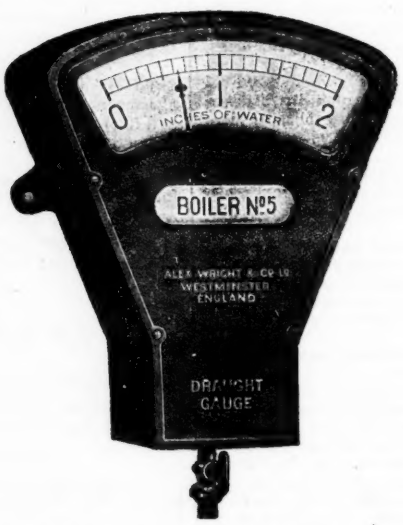

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Incorrodible, Accurate, for foul or purified gas.

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cannot yet be sold at a paying price, although a little crystal 40 p.ct. has gone to Japan lately. Cresylic acid is rather more active; pale 97-99 p.ct. being worth 2s. 6d., and dark 95-97 p.ct. 2s. 4d. per gallon. Naphthalenes are idle, with crude at £8 per ton, and refined £17 10s. In intermediate products there is rather more business with the re-opening of the works after the holidays; but very little change in prices is to be noticed so far.

Sulphate of Ammonia.

The demand for this material for home use remains fairly steady, and although a slight increase of 4s. per ton has been announced for September prices, and for October of another 3s., there are still many buyers anxious to fill their requirements for the coming season before a further advance takes place, as is anticipated. Export prices are rather higher for spring delivery, and a very fair amount of business has been done.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Aug. 10.]

Nos. 20,509 to 20,954.

BARRETT, J.—"Combined stop and relief valve for control of gas or liquid." No. 20,655.
DAVIS, H. N.—"Furnaces." No. 20,711.
EWART, J. W.—"Water heaters." No. 20,852.
HARRISON, H.—"Gas-retorts, &c." No. 20,626.
LARKIN, F. S.—"Boilers." No. 20,611.
MONARCH MANTLES, LTD.—"Light-giving bodies for incandescent lighting. No. 20,596.
REDFERN, C. G.—"Gas-producers." No. 20,590.
SMEETON, G. H.—"Utilization of waste heat in furnaces, &c." No. 20,524.
SOC. ANON. RADIOLUX.—"Apparatus for simultaneously illuminating and heating." No. 20,945.
STIMEX GAS-STOVE COMPANY, LTD., and STIMSON, E. F.—"Thermostats for gas-heated hot-water circulators, &c." No. 20,657.
STIMSON, E. F. H.—"Geysers." No. 20,658.
STUART, H. A.—See Redfern. No. 20,590.
TERRELL, T.—See Monarch. No. 20,596.
WICKETT, J. H.—"Gas stoves, grates, &c." No. 20,586.
WRIGHT, R. F.—See Barrett. No. 20,655.
YOUNG, D. J.—"Manufacture of gas." No. 20,612.

The Dymond Tar Chemicals and Fuels, Ltd., is a private company, with a capital of £30,000, formed to carry on the business of tar distillers, &c., at Headlands works, Liversedge.

Padiham District Council Gas Department.

In his third annual report to the Padiham Urban District Council Gas Committee, Mr. A. F. Ames (the Engineer and Manager) says the quantity of gas sent out in the year to March 31 was 97,050,000 c.ft.; the increase in the quantity sold, as compared with the preceding twelve months, being 5,872,000 c.ft. The unaccounted-for gas was 4·08 p.ct. The gas made during the year averaged 13,657 c.ft. per ton of coal carbonized, and was the best result yet obtained by the department. The gas accounted for was also the highest result yet obtained, being equal to 13,092 c.ft. per ton of coal carbonized. The quality of the gas averaged 500 B.Th.U. (gross). The net cost of coal, after deducting receipts from residuals, was 9s. 6d. per ton, as compared with 10s. 7½d. in the preceding year. The receipts from residuals were equal to 27s. 10d. on the cost of coal per ton into store—or 74·5 p.ct.—against 17s. 2½d. a year ago. The following comparison is made of the total wages paid per 1000 c.ft. of gas sold: 1914-15, 6·22d.; 1918-19, 11·53d.; 1919-20, 13·33d.; 1920-21, 17·29d. The financial results of the year exceeded all expectations, and resulted in a net profit of £2530. The average net cost to the department of the gas sold during the year, including all charges, was 4s. 3·27d. per 1000 c.ft.; this figure including 16·36d. for rates, taxes, and capital charges. The average price received for the gas was 4s. 9·7d. per 1000 c.ft., an increase of only 77 p.ct. over the pre-war charge.

Bland Light Syndicate, Ltd.—The thirteenth annual general meeting was held at the Company's registered offices, No. 29, Little Trinity Lane, E.C., on Friday, July 29—Mr. F. J. Gould in the chair. A final dividend at the rate of 14 p.ct. per annum was declared, making 10 p.ct. for the year ended April 30.

Dublin Gas Consumers' Protest.—A deputation from the Dublin Gas Consumers' Protection Association, received by the Dublin Corporation last week, stated that great dissatisfaction prevailed at the proposal of the Alliance and Dublin Consumers' Gas Company to raise the price of gas from 7s. 6d. to 8s. 4d. per 1000 c.ft., and pointed out that in most English and Scottish towns gas was very much cheaper, while even in Belfast it was sold at one-half the proposed Dublin figure.

City of Chichester Gas Company.—The accounts for the half year to June 30 show an increase in rental, due to the higher price per 1000 c.ft. charged by the Company for gas resulting in a larger profit. The new carburetted water-gas plant was put to work in January, and has since been in successful operation. The balance standing to the credit of the profit and loss account (net revenue) amounts to £2647, out of which the Directors recommend the declaration of a dividend for the six months at the rate of 5¾ p.ct. per annum upon the "A" capital stock, and £4 0s. 6d. p.ct. per annum on the "B" and "C" capital stocks, all less income-tax. This will absorb £901.

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THE "N. C." COKE GRATE.

An open fire grate for use with ordinary gas coke. Complies with the recommendations of the Coal Smoke Abatement Committee.

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Full particulars on application.

Croydon Gas Company.

The Directors will report, at the half-yearly meeting on Friday, that the progress of the Company has been retarded, and the cost of working greatly increased, by the coal strike. Nevertheless, as compared with the corresponding period of 1920, the sale of gas shows an increase of 1·17 p.ct. In the half year the number of consumers has increased by 648. Under the powers of the Croydon Gas Company (Capital Issues) Consent, 1920, an issue, which was over-subscribed, was made in May of £120,000 of 7½ p.ct. preference stock at 96 p.ct., redeemable at par on July 1, 1936. On Nov. 20, application was made to the Board of Trade for an Order under section 1 of the Gas Regulation Act providing for the sale of gas on a therm basis. The Order became operative on April 1. The calorific value of gas which the Company have given notice of their intention to supply is 470 B.Th.U. The old standard price per 1000 c.ft. in the Croydon area was 4s. 7d.; and the new standard per therm is 17⅞d. The maximum additional price in the Caterham area is now ⅝d. per therm, in place of 4d. per 1000 c.ft. The standard rates of dividend on the "A," "B," and "C" stocks rise by ⅛ p.ct. per half year for each ⅛d. per therm by which gas has been sold to ordinary consumers in the Croydon district below the above-named standard price. The price charged in the Croydon area has been, since April, 13⅛d. per therm—this representing a reduction equivalent to about 1d. per 1000 c.ft. The Directors hoped to effect a further reduction in price; but the losses arising from the coal strike, which will extend into the current half year, render it necessary to advance the price as from Oct. 1 to 13⅜d. per therm in the Croydon area, and 14⅜d. in the Caterham area. After providing for all fixed charges, the balance available for division is £19,559. The Directors recommend that dividends be declared for the past half year at the following rates per annum, all less income-tax: "A" stock, 15 p.ct.; "B" and "C" stocks, 12 p.ct.; "D" stock, 5 p.ct.; "E" stock, 10 p.ct. These are the pre-war rates of dividend on the "A," "B," "C," and "E" stocks; and their payment will necessitate the withdrawal of £8400 from the reserve fund.

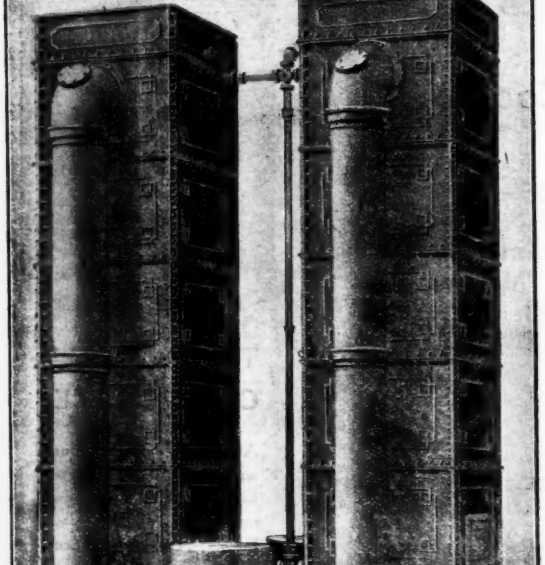
A Birmingham Memorial.—A scheme has been approved by the Birmingham Gas Department for the erection of a statue (having a symbolical life-size figure of Peace, on a heavy pedestal) to the memory of employees who gave their lives in the war. The memorial, which will be placed in the large front office of the department, in Edmund Street, will bear a suitable inscription, together with the heraldic arms of the city.

Lighting Places of Entertainment.—The Chief Constable submitted, at a meeting of the Sheffield Watch Committee, information he had obtained from other towns with regard to the installation of two systems of lighting at places of entertainment, and as to the practice adopted in Sheffield. As a result, the Committee decided to recommend the installation of a duplicate lighting system in all these places, and asked the Town Clerk to prepare a regulation to this effect.

Gas Company's War Memorial Unveiled at Portsmouth.

In Portsmouth, last Thursday, at the principal offices of the Portsea Island Gas Light Company, was unveiled a handsome bronze tablet to preserve the memory of the employees of the Company who fell in the Great War—the ceremony taking place in the presence of a large gathering of employees, shareholders, and others interested. The unveiling was performed by Mr. Alfred Meadus, who has been in the service of the Company for 49 years; and it revealed a fine tablet executed in bronze bearing the names of 29 men. On the left side of the names is the figure of a soldier with his rifle, and on the right that of a sailor with a telescope, while overhead is placed a laurel wreath. Immediately above the names are the words "Honour, Duty, Sacrifice," and below is the inscription: "This tablet is dedicated to the memory of the men of the Portsea Island Gas Light Company who gave their lives in the Great War, 1914-1918. Erected by the Executive and Employees, 1921." Then follow the names. After the unveiling, seven beautiful wreaths were placed at the foot of the tablet by the Chairman and Directors, the chief officials and office staff, the Hilsea workmen, the Flathouse workmen, the Rudmore workmen, the fittings and lighting department, and the Social and Athletic Club. In addressing the gathering, Mr. W. Gillman (the Deputy-Chairman), officiating in the absence of the Chairman, said they were met to do honour to the memory of those of their fellow workmen who went out to the war and did not return. In common with 298 of their comrades, whom they were able to spare, they responded to the call for volunteers; and those whom they could not release, and the women who came to their help for war service, might justly say that it was the willing way they tackled the additional work and responsibilities thrown upon those left behind which made it possible for the Company to show such a good record throughout the whole period of the war. The privilege of bearing the expense of the memorial had been shared by the Company and the staff.

Midland Gas-Fitters' Wages.—Following a conference between representatives of the Birmingham, Walsall, West Bromwich, and Smethwick Gas Departments and the Birmingham and District Master Gas-Fitters (for the employers), with delegates representing the National Gas Fitters' and Allied Workers' Trade Union, the following reductions in gas-fitters' wages have been agreed to: From Aug. 1, 1½d. per hour, to 2s. 0½d. per hour. From Oct. 1, 1½d. per hour to 1s. 11d. per hour. The agreement provides that after Oct. 1 wages will be regulated by a sliding-scale based on the Board of Trade index number of the cost of living; and for every five points variation in the index number from a basis of 134 points, wages will rise or fall ½d. per hour. This is to become operative from the first pay day in November following the publication of the October index number. After November wages are to be revised every three months, in the light of the cost of living figures for the previous three months. If and when the index number of cost of living falls to 70 above the pre-war level, the whole situation will again be reviewed.



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Loss at Greenock.—The year's accounts show that the Greenock gas undertaking has had a loss of £9100; and the accumulated balances of the last three years, amounting to £12,800, have been absorbed. The present price of gas is 3s. 1½d. per 1000 c.ft.

Ministry of Health and Gas for Housing Schemes.—It was moved by Mr. Jackson, at last Wednesday's meeting of the Sheffield City Council that the Estates Committee be requested to place with the Sheffield Gas Company at once an order for the laying down of the gas mains and services required to provide a supply of gas to the 42 houses recently erected at Wadsley for the Corporation, without waiting further for the approval of the Ministry of Health to the terms. He explained that there was a difficulty as to the responsibility for the expenditure; but in the meantime the residents were suffering considerable hardship and inconvenience. During the recent coal dispute, as they had no gas, they had to purchase wood every time they wanted to do any cooking. The resolution was carried.

Perth Gas Price.—Mr. Hunter, at the Perth Town Council meeting, said foreign coal during the strike cost £6320 in excess of estimates. The gas-rate is increased by 10d. to 5s. 8d. per 1000 c.ft.

Overcharge or Undercharge.—It was reported at a meeting of the Dalton-in-Furness Gas Committee last week that the defendant in a case which had been taken to the County Court for non-payment of a gas account had sent a long letter to the Council, alleging overcharge, and contending that the meter had not been taken away and checked when he requested that this should be done. He said the 10,000 c.ft. charged for in one particular year was more than he ever consumed, either before or since. The Gas Manager (Mr. C. Parkinson) informed the Committee that he had not been in a position to remove the meter at the time requested; but when it was checked it was found to be 5 p.ct. slow. The meeting agreed that in this case there was an undercharge, rather than an overcharge; and the matter was left in the hands of the County Court.

STOCK MARKET REPORT.

THERE was not much change in the condition of things on the Stock Exchange last week; business being of course on the reduced holiday scale, and the general tone, after a fair opening, becoming distinctly dull.

The gilt-edged market naturally felt the influence. Home Government issues were weaker generally. In the big four, Consols and Funding were losers; Friday's figures being: Consols 48-48⅛, War Loan 88-88¼, Funding 71⅛-71½, Victory 76⅜-76⅞. Bonds too were lower; but Colonials were fairly steady. Home Rails were dull, and Canadians were easier; but Argentine priors were wanted.

The Foreign Market was tolerably busy, and Argentine, Chilian, Brazilian, and Japanese were in good demand. Something was done in Russians; but they were very variable.

Business in the Gas Market was much more active than of late and the tone was quite favourable. Gas Light and Coke issues were quoted at *ex div.* rates; and all three gained by the adjustment. South Metropolitan was firm. A feature of the week was the dealing in the 6½ p.ct. debentures, which, where fully paid, touched 100$\frac{1}{16}$. Commercial was steady. In Suburban and Provincial, new quotations *ex div.* of Bournemouth, Maidstone, South Suburban, Tottenham, and Wandsworth showed advanced values. In Continentals, European was firm and Imperial unchanged. Primitivas showed a disposition to improve and commanded better prices.

Bargains done for cash during the week were as follows: On Monday, Bournemouth "B" 8⅞, 8$\frac{15}{16}$, British 23, 23$\frac{1}{16}$, 23$\frac{1}{8}$, 23¼, Gas Light ordinary 58⅛, 58⅜, 58½, 58$\frac{9}{16}$, 58⅝, ditto debenture 51⅞, Imperial Continental 128⅛, Newcastle 57⅞, Primitiva 9s., ditto preference 25s. 6d., South Metropolitan 66, ditto 6½ p.ct. debenture, £5 paid, 7-7⅞, Woking 8 p.ct. preference £100. On Tuesday, Bournemouth preference 8, Brentford "B" 6$\frac{3}{16}$, Cape Town preference 4½, Commercial 4 p.ct. 53½, Gas Light ordinary 58⅛, 58⅛, 58¾, ditto debenture 51⅞, Newcastle 57⅛, Primitiva 9s. 10½d., South African 8, South Metropolitan 65⅛, 66, 66¼, South Suburban 66⅜, Southampton 56½, South Metropolitan 6½ p.ct. debenture 7⅞-8⅛. On Wednesday, Bournemouth "B" 9$\frac{1}{16}$, ditto preference 8¼, Brentford 5 p.ct. 65, ditto "B" 6$\frac{3}{16}$, European 7⅛, Gas Light ordinary 58⅛, 58⅜, 58½, 58¾, 58⅞, 59, ditto maximum 45, Imperial Continental 127, Primitiva 9s., South Metropolitan 65⅛, 65⅜, 65⅝, 66, 66⅛, 66⅛, ditto debenture 48, South Suburban 65⅛, 66, Southampton 57, South Metropolitan 6½ p.ct. debenture 7⅞-8⅛. On Thursday, Brentford 5 p.ct. 65, 66, Gas Light ordinary 58⅜, 59, 59⅜, ditto maximum 44½, ditto preference 59⅜, ditto debenture 52, Imperial Continental 127, 128, 128½, 129 (and exceptional 100), Primitiva 10s. 6d., 11s., ditto preference 26s. 9d., 27s., 27s. 6d., South Suburban 66, South Metropolitan 65⅜, 66, 66⅛, ditto 6½ p.ct. debenture £17 paid, 19⅛, 20⅛, Brighton and Hove 6 p.ct. preference "B" 88, On Friday, Brentford 5 p.ct. 65⅛, 66, Cape Town preference 4⅜, Commercial 4 p.ct. 55, Continental Union 19, European 7⅛, Gas Light ordinary 56⅛, 56⅜, 56⅞, 57⅛, 59, ditto preference 52, Imperial Continental 128, 128½, 129 (and exceptional 112½, 126½, 131½), Primitiva preference 28s., 29s. 9d., 30s., South Suburban 64, ditto debenture 74, South Metropolitan 65⅜, 66, 66⅛, ditto 6½ p.ct. debenture, £17 paid, 19⅜, 20⅛, and fully-paid 99½, 100$\frac{1}{16}$, British Norwich 3 p.ct. debenture 42⅛, 42⅜.

In the Money Market, there was a sharp demand which ruled almost up to the close of the week. Discount rates also hardened and maintained their figures throughout. Silver gave way, but made a partial recovery later. The Bank rate is 5½ p.ct., as fixed on July 21.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Mar. 11	4	4%	Aldershot 4 p.c. Pref.	...	53—58	...
1,551,868	,,	Apl. 14	2½	3⅛%	Alliance & Dublin Ord.	59—64	43—46	...
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	...
280,000	5	Aug. 11	7½	4/-	Bombay, Ltd.	5½—6½	3½—3¾*	...
100,000	5	,,	16	4/7½	Bournemouth Gas and Water: 5 p.c.	...	7½—8½*	...
383,110	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	8½—9¼*	8⅞—9⅛
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	7½—8½*	8—8½
162,065	—	June 30	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	...	54—59	...
992,045	Stk.	July 15	14	56/-	Brentford A Consolid.	261—266	63—68	65—66
734,920	,,	,,	11	55/-	Do. B New	204—209	60—65	63½
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	67—71	...
221,400	,,	June 15	4	4%	Do. 4 p.c. Deb.	91—93	56—58	...
214,775	,,	Mar. 11	7½	7½%	Brighton & Hove Orig.	208—213	102—107	...
244,200	,,	,,	8	8%	Do. A Ord. Stk.	154—159	75—80	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Mar. 30	12½	10%	British	44—45	22—24	23—23½
120,000	Stk.	June 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	53—56	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	36—39	...
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd.	1¼—2½	6½—7½	...
100,000	10	Apl. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½	4½—4½
100,000	Stk.	June 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	53—58	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	53—58	53½—55
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do.	103—105	50—55	...
475,000	,,	June 15	3	3%	Do. 3 p.c. Deb. Stk.	69½—72½	42—45	...
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	17—22	19
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	30—40	...
51,600	,,	Feb. 5	15	10%	Croydon A 10 p.c.	...	125—135	...
278,400	—	,,	12	7%	Croydon B and C 7 p.c.	...	95—105	...
492,270	Stk.	—	6	4½%	Derby Con. Stk.	125—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	7—8	7½—7½
16,298,975	Stk.	Aug. 11	4/17/4	46/8	Gas Light and Coke: 4 p.c. Ord.	98—102	56—59*	56½—56½
2,600,000	,,	,,	3½	35/-	Gas Light and Coke: 5½ p.c. max.	76—79	43—46*	44½—45
4,062,235	,,	,,	4	4%	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	57—60*	59—59½
4,674,850	,,	June 15	3	3%	Gas Light and Coke: 5 p.c. Con. Deb.	72½—74½	50—53	51½—52
130,000	,,	Dec. 11	10	10%	Gas Light and Coke: 10 p.c. Bonds.	...	...	...
82,500	,,	Mar. 11	5	3⅛%	Hastings & St. L. 5 p.c.	...	48—53	...
258,740	,,	,,	3½	2⅛%	Do. 5½ p.c.	87—89	34—39	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16¾	5—6	...
86,600	Stk.	Mar. 11	9	5⅝%	Hornsey 7 p.c.	...	75—85	...
131,000	,,	July 28	7½	7½%	Ilford A and C	151—154	76—81	...
65,780	,,	,,	6½	5⅜%	Do. B	115—118	55—60	...
65,500	,,	June 30	4	4%	Do. 4 p.c. Deb.	92—94	53—55	...
1,976,000	,,	May 27	9	5%	Imperial Continental	150—160	127—132	127—129
1,235,000	,,	Aug. 11	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	77—82*	...
235,242	,,	Mar. 30	6½	3¼%	Lea Bridge Ord. 5 p.c.	119—121	68—73	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. A.	211—213	...	...
					Liverpool 5 p.c. Ord. B.	146—148	...	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 11	7/5/6	6%	Maidstone 5 p.c.	...	52—55*	...
63,480	,,	Dec. 30	—	3%	Do. 3 p.c. Deb.	...	40—43	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4½—4¾	1⅞—2⅛	...
250,000	100	Apl. 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	88—93	...
541,920	Stk.	May 27	4	6%	Monte Video, Ltd.	11½—12	60—70	...
1,875,892	,,	July 28	4½	5%	Newcastle & Gatsh'dCon.	98½—99½	57½—58½	57⅝—57⅞
529,705	,,	June 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	48½—50½	...
15,000	10	Mar. 11	—	8%	North Middlesex 10 p.c.	...	12½—13½	...
55,940	10	,,	7/14/0	58⅜%	,, ,, 7 p.c.	14—15	7½—8½	...
300,000	Stk.	May 12	8	8%	Oriental, Ltd.	117—122	88—93	...
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	...
188,120	Stk.	June 30	—	3½%	Plym'th & Stoneh'se 5 p.c.	...	53—58	...
60,000	50	Feb. 25	13	7½%	Portsea Island, B	128—131	65—70	...
100,000	50	,,	12	6½%	Do. C	118—121	50—55	...
249,980	5	April 29	1	—	Primitiva Ord.	5½—6	1—1	9/—9/11
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4½—5	1½—1½	25/6—30/-
521,600	100	June 1	4	4%	Do. 4 p.c. Deb.	91—93	65—67	...
600,000	Stk.	July 28	4	4%	Do. ,, ,, 1911	...	36—39	...
346,198	,,	June 30	4	4%	River Plate 4 p.c. Deb.	85—87	36—39	...
150,000	10	Mar. 30	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5½—6½	...
125,000	50	June 30	5	5%	San Paulo 5 p.c. Deb.	47—49	34—39	...
135,000	Stk.	Mar. 30	10	5%	Sheffield A	223—224	63—64	...
209,984	,,	,,	10	4½%	Do. B	222—224	62—64	...
523,500	,,	,,	10	3½%	Do. C	220—222	61—63	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	June 30	9	8%	South African	10½—11½	7—9	8
6,609,895	Stk.	July 28	5/4/-	5%	South Met. Ord.	111—113	65—67	65½—66½
250,000	,,	July 14	—	5%	Do. Red. Pref.	...	92—94	...
1,895,445	,,	,,	5	5%	Do. 5 p.c. Deb.	72½—74½	46—49	48
224,820	,,	Feb. 25	8½	7½%	South Shields Con. Stk.	157—159	85—87	...
1,087,795	,,	Aug. 11	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	62—67*	64—66½
368,837	,,	June 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	72—77	74
647,740	,,	May 12	7½	3½%	Southampton Ord.	99—102	55—58	56½—57
121,275	,,	June 30	4	4%	Do. 4 p.c. Deb. Stk.	...	56—58	...
120,000	,,	Aug. 11	—	6%	Tottenham A 5 p.c.	135—138	60—65*	...
782,275	,,	,,	6	4½%	Tottenham B 3½ p.c.	115—117	52—57*	...
181,255	,,	June 15	4	4%	District 4 p.c. Deb.	87—89	52—55	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Feb. 25	3	3½%	Tynemouth 5 p.c. max.	108½—109	68—70	...
					Wandsworth, Wimbledon, and Epsom—			
50,000	,,	Aug. 11	8½	66/3	Wandsworth A 5 p.c.	151—156	77—82*	...
255,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	54—59*	...
108,075	,,	,,	—	46/4½	Do. C	...	54—59*	...
140,865	,,	,,	—	46/4½	New Ordinary	...	54—59*	...
552,000	,,	,,	6½	45/-	Wimbledon 5 p.c.	117—122	52—57*	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c.	121—126	54—59*	...
88,416	,,	June 30	3	3%	5 p.c. Deb. Stk.	66—69	40—45	...

* Ex Div.

Reduction Per Therm at Brighton.—The Brighton and Hove General Gas Company announce that the price of gas, as registered by ordinary meter, will be reduced by ½d. per therm, as from the Michaelmas reading of the meters. This reduction, the Directors point out, is equivalent to nearly 2½d. per 1000 c.ft.

Southend Gas Fatality.—The inquiry was concluded at Southend on Monday last into the circumstances attending the death of Arthur Jarvis, which occurred in a manner already recorded in the "Journal" [*ante*, p. 332]. He was, on Aug. 4, discovered in bed dead from gas poisoning; and the Jury found that there was some neglect on the part of the Gas Company in not exchanging the meter at his house. The widow (who was discovered unconscious at her husband's side) stated that there had been a smell of gas in the house for about five weeks. About July 16 her husband went to the Company about it; and a man came and examined the meter, and said it leaked near the slot. The meter had not been changed by Aug. 3. On that night, she shut the bedroom window, because she felt cold, and closed the door, because there were lodgers in the house. Mrs. Heard (who, with her husband, stayed at the house on the night of the occurrence) stated that she smelt gas about half-an-hour after retiring. The smell got stronger, and she and her husband were ill on and off throughout the night. The Company's Engineer (Mr. T. F. Canning) said the meter had been found to leak to the extent of 3-5ths of a cubic foot per hour. The leakage was not sufficient to endanger life. There was no other leak to account for the gas, unless someone had left a burner on accidentally.

The Lurgan Gas Committee reported to the Urban Council that they were considering the question of securing funds for the extension of the gas-works, and that tenders for supplying water-gas plant had been received.

The half-yearly report of the Kirkham Gas Company shows a profit on the six months' working of £388. With £1738 brought forward from last half year, there is a total balance of £2120, with a disposable sum of £1794. A dividend of 6 p.ct., less tax, is recommended for the year.

The Bulletin for Aug. 9 of the Federation of British Industries contains a new feature in the first issue of the "Taxation Supplement." The aim is to furnish a monthly record of questions affecting the taxation of industry. Conciseness will be the keynote. By careful compilation, it is hoped that, as a reference to taxation laws and practice, the supplement will be found valuable to members of the Federation.

At an inquest on the body of Harry Holden, a miner, of Askern, who was found dead in a bedroom at his lodgings with a gas-pipe near his mouth, Eli Blount (with whom Holden lodged) said deceased appeared to enjoy good health, but had been depressed because he was out of work. Only part of Askern Main had been re-opened since the coal stoppage; and Holden was one of those who could not resume. So far as he knew, the only relief Holden received, apart from the Association vouchers, was 5s. A verdict of "Suicide while temporarily insane" was returned.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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